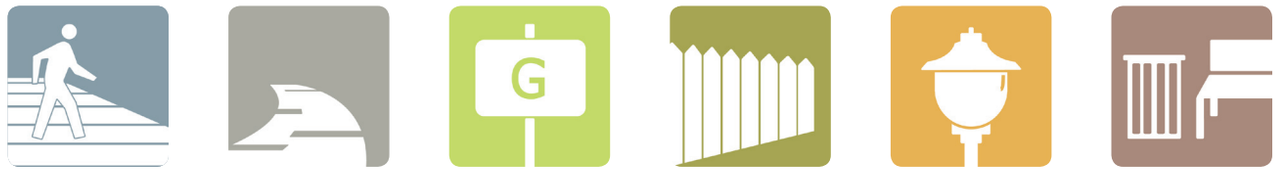
GREENWAY GUIDELINES FOR THE EAST TENNESSEE REGION:
RECOMMENDATIONS FOR WATER, RAIL, AND ROADSIDE TRAILS IN REGIONAL LANDSCAPES



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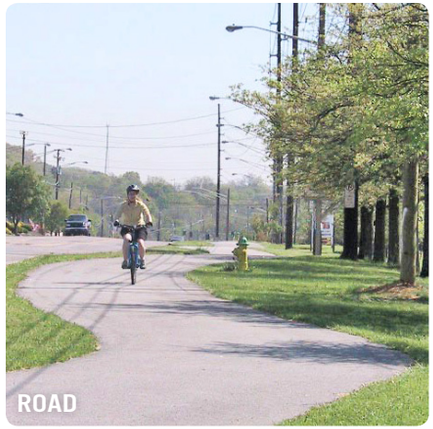
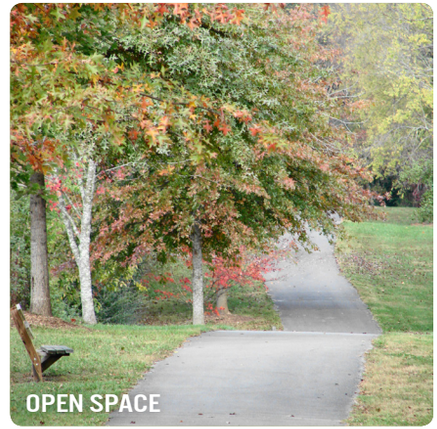




From left to right: roadside trail in road right-of-way, rail right-of-way with railside trail, waterside trail in waterside easement, trail in public recreational open space.

INTRODUCTION

People in East Tennessee may think of a greenway as a pleasant tree-lined walking loop in their local park, or a bicycle trail next to a creek. However, a single greenway can be part of a much wider system. If linked to other greenway corridors in the community, county, and the East Tennessee region, it would form a regional greenway system. As part of a regional greenway system, each local greenway trail and corridor provides communities with transportation routes, recreation, flood mitigation, preservation of cultural and environmental landscapes, and other social and economic benefits.

PART I of this guide provides a brief introduction to the benefits and design of community, county, and regional greenway corridors and systems. It discusses settings common to East Tennessee, such as rural, suburban, urban, or town center, as well as open spaces. Layout, design, and location of trail segments, trail surfaces, maintenance and buffer areas are also introduced. A **Glossary of Common Trail Design Terms** concludes Part I.

PART II provides examples of greenway corridors in typical East Tennessee settings. East Tennessee's ridge and valley terrain limits the number of continuous routes available, so greenway corridors often need to share existing road, rail, utility, open-space, or water-feature corridors, particularly in town centers and suburban settings. Thus examples in Part II focus on illustrating corridors in **roadside**, **railside** and **waterside** settings. Illustrations based on actual landscape settings from the region provide realistic before-and-after examples of potential greenway corridors.

PART III includes **Visual Indexes** that illustrate details and specific examples of trail crossings, trail surface materials, trail signage, buffers and barriers, lighting, and amenities suitable for the East Tennessee region. **Appendices** at the end of Part III provide further information on trail maintenance, guidelines for the use of mile markers, examples of plants that are used successfully in regional corridors, a Sidepath Checklist, and regional guidelines for signing and marking greenway trails.

BENEFITS OF GREENWAY SYSTEMS, CORRIDORS, AND TRAILS

Great greenway trails and corridors provide access for many different types of users to a rich variety of places, experiences, activities, and landmarks. Local greenway paths situated near urban and suburban housing developments offer residents everyday opportunities for exercise, access to nearby parks, and a chance to experience seasonal flora and fauna. When these local greenway paths connect to one another, they become part of a larger greenway corridor that can link neighborhoods. These corridors are useful for commuters heading to work in town centers and business parks. They also as provide access to regional recreational amenities for residents and visitors alike. As the greenway corridors develop, they can grow into a regional greenway system that encompasses multiple counties and metropolitan areas, providing connections between population centers and amenities such as state and national parks.

Greenway trails and corridors also provide many benefits that may seem less tangible at first glance, but contribute to an improved quality-of-life in important ways. When placed between roads or railroad tracks and residential developments, greenway corridors act as a buffer for noise and air pollution. Where a greenway corridor follows the perimeter of a commercial development or parking lot, it can act as a sponge for stormwater run-off and help reduce the need for new storm sewer capacity. Along a stream or river, a vegetated greenway corridor filters pollutants in stormwater run-off before it enters adjacent waterbodies. In all of these areas, greenway corridors help preserve habitat for local flora and fauna.

HOW TO USE THIS GUIDE

This guide is valuable for readers who are just beginning to learn about greenways and those already familiar with the subject matter. If the reader is an elected official, community organizer, or neighborhood advocate interested in starting a greenway movement in their own community, the guide may be read cover to cover. Part I outlines the core principles of greenway development, explaining the benefits of greenway trails, defining commonly used terms, offering tips on funding sources, and presenting the basics of determining a route for a new corridor. Part II illustrates how trails can be accommodated in common East Tennessee landscapes and offers compelling before-and-after images. This information is vital for readers who aim to inspire and encourage greenway development in their community.

Experienced readers, including transportation planners, urban planners, municipal engineers, veteran trail advocates, and design professionals, may use this guide as a general reference. The greenway corridors illustrated in Part II cover roadside, railside, and waterside greenways in a range of local landscape conditions and will be helpful to professionals who can refer to the specific example most similar to the trail they are working with. Of particular interest to experienced readers are the Visual Indexes in Part III, which graphically demonstrate solutions to common greenway obstacles and illustrate examples of amenities, materials, border conditions, buffer ideas, and signage commonly used on successful trails. Helpful appendices provide information on suitable local plants, trail maintenance, signage, and other topics.

Rather than a detailed construction or technical reference manual, this guide is meant to foster a general understanding of both the benefits and challenges associated with building greenways in East Tennessee. For detailed information on specific topics, this guide directs the user to the appropriate technical manuals and codes that have been developed by government agencies, transportation groups, professional organizations, and trail advocates.

TRAIL DESIGN AND LOCATION

DESIGN OF GREENWAY SYSTEMS, CORRIDORS, AND TRAILS

Great greenway corridors not only allow visitors and residents to access a rich variety of uses, special experiences and places, seasonal flora and fauna, landmarks, activities and route options, but also opportunities to create new memories with every visit – both in and adjacent to the corridor.

Keys to building a great greenway system include:

- Information about users and their needs
- Help and support of local communities and trail supporters
- Assistance from experienced greenway designers

Greenway System: A set of greenway corridors, trails and associated accesses that interconnect and function as a whole to serve community, county or regional users. Each trail retains its local distinctiveness and character; however, some elements like signage may be similar or standardized to help users find their way through the system. Greenway systems can connect parks, wilderness preserves, cultural facilities, and historic sites with business, residential, and rural areas.

Often the first greenways a community builds are recreational loop trails or streamside trails in parks. These trails form an important foundation for a greenway system, but often serve only residents who are able to drive to the parks where they are located. A fully developed community or regional greenway system serves many different users and activities, and serves as an alternative transportation system for those who choose not to or cannot drive. Community greenway systems are particularly beneficial to the health and welfare of children, young families, and community members who need convenient places for daily activity.

This section introduces community members to some of the steps required to start building greenway corridors and systems. It also defines some terms commonly used in greenway planning. Steps covered include:

1. Understand Your Community, County, and Region
2. Organize Community Support and Resources
3. Identify Multiple Uses for Greenway Corridors
4. Identify Potential Routes, Corridors, and Connections
5. Secure Places for Trails
6. Plan for Connection, Access, and Variety of Routes
7. Determine Trail Surface Type and Location
8. Consider Maintenance and Buffer Areas

1. UNDERSTAND YOUR COMMUNITY, COUNTY, AND REGION

Greenway corridors can occur in many landscape settings. Some of the first questions a community might ask include:

- Are local landscapes rural, suburban, urban or open-space?
- Are there continuous corridors of recreational, waterside, railroad or utility land that pass through the community?
- What are the historic, interesting or scenic places in the community?

A good exercise for understanding the character of local landscapes is to have community members share, via a website or meetings, historical pictures and pictures of their own favorite local landscapes and places.

In this publication, we focus on providing examples for rural, suburban or urban settings, and commercial or residential zones, because these are often more difficult locations to see the potential for designing corridors. However, a community should also take full advantage of opportunities for locating trails, trailside amenities, and trailheads in parks and other community open-space settings.

Open space settings
Often include some combination of passive and active parks, agricultural fields, woodlots, woodlands, floodplains, unimproved drainages or hillsides, undisturbed open space, and other natural features. Open space settings can be found in rural, suburban or urban locations, and are a primary component of rural settings.

Rural Settings
Often include some combination of agricultural land, rivers, creeks, unimproved drainages, hillsides, undisturbed open space, and other natural features.

Suburban Settings
Often include low-density residential housing communities and highly developed commercial areas along major roadways. They often feature larger parks and sports complexes.

Urban and Town Center Settings
Often include a mix of residential, commercial, and entertainment uses. They vary in scale from small towns to large cities. Parks are usually of mixed size and use.

UNDERSTAND GREENWAY USERS, NEEDS, DESTINATIONS, AND OPPORTUNITIES

Some of the first questions a community might ask include:

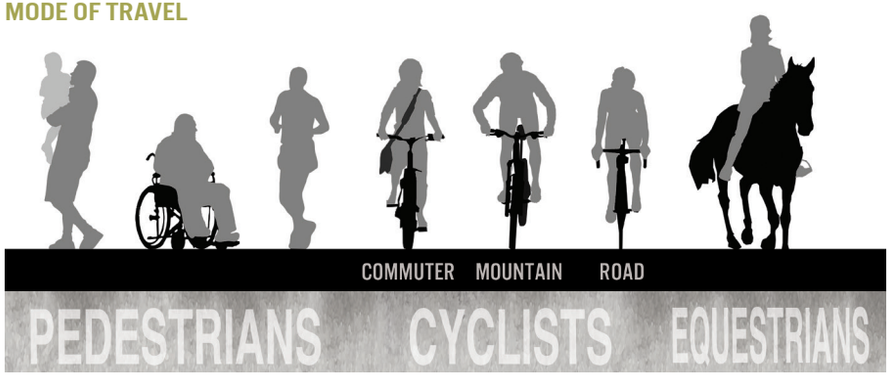
- Who might use greenways in the community?
- Where do these potential users live, work, and attend school?
- What are the needs of the community residents – exercise, economic development, tourism, and / or transportation?
- What are the goals for community, county, and regional greenways?

This is a very practical exercise, where local residents are one of the best sources of information. At these meetings, groups gather and brainstorm about who might use local greenways, discuss the activities greenway users would enjoy, and place colored dots or notes on a map to identify special places in the community. Groups might start by thinking about:

- local places where children and other non-drivers need to go, such as schools, places of worship, social clubs, recreation and community centers, employment centers, transit connections, grocery stores, and shops
- recreational fields, parks, waterfronts, courthouse squares, public gardens, historic or cultural sites and other places that appeal to both residents and tourists
- places that can support different types of tourism, for example agricultural, bird-watching, wilderness or horseback tourism
- special or scenic landscapes and other places that can be connected together to tell a story about the local communities and regional history

After this meeting, organizers use meeting notes to identify typical greenway users for the community, modes of travel that community greenways might need to accommodate, and potential destinations and routes for greenway users.

MODE OF TRAVEL



Mode of travel is the term transportation planners use to describe the means a person uses to travel along a route. This guide discusses three non-motorized modes of travel common to greenway use in East Tennessee:

- pedestrian travel, which includes walking, hiking, or running, and wheelchairs, strollers, canes, and other assistance that people use during these activities
- bicycle travel, which includes use of a broad variety of bicycle types, including recreational, commuter, mountain, and road bikes
- equestrian travel, which involves either riding or leading a horse or other pack animal

UNDERSTAND WHERE GREENWAY USERS LIVE, WORK AND ATTEND SCHOOL

Planners refer to areas of a community where people live or work adjacent to a greenway corridor and can easily reach the corridor as the **trailshed** or **user catchment** for the corridor. The size and shape of a trailshed is affected by the time a potential visitor travels, the travel mode (by foot, bicycle, horse or automobile) a potential visitor uses to reach the greenway, and locations of any barriers to travel – for example, rivers or highways that prevent a visitor from reaching the corridor by their chosen mode.

Typically during evaluation of corridor routes, a planner helps a community identify pedestrian, bicycle, automobile and, if relevant, equestrian trailsheds for a corridor to make sure there are plenty of potential users who are close enough to visit the corridor regularly.

GREENWAY CORRIDOR AND PEDESTRIAN, BICYCLE, AUTOMOBILE TRAILSHEDS

Example: the Greenbelt Park trailhead for the Maryville-Alcoa Greenway

pedestrian trailshed: 1 mile
bicycle trailshed: 3 miles
automobile trailshed: 10 miles

2. ORGANIZE COMMUNITY SUPPORT AND RESOURCES

BUILD FUNDING, SUPPORT AND TRAIL COMMUNITY

The success of any greenway corridor plan is dependent upon building community support and finding the necessary resources for funding and implementation. It is critical to invite ideas and involvement from interested stakeholders and neighbors as early as possible in order to instill a sense of ownership in the project. Community design workshops and frequent communication through newsletters and blogs are good ways to keep people informed and give them input in the final design.

Trail Community: Includes those with an interest in, or relationship to, a particular trail, such as trail users, volunteers, landowners, and the officials and citizens of local communities through which the trail passes. The Appalachian Trail Community is an example.

POTENTIAL FUNDING SOURCES

A large portion of the funding may come from a local government agency that is directly associated with the project, such as a city parks and recreation or public works department. In addition, it may be possible to secure state or federal transportation funding. Three sources for those funds are your local TPO/MPO, the state Department of Transportation (DOT), and the state Department of Environment and Conservation. The Transportation Planning Organization (TPO) or Metropolitan Planning Organization (MPO) is a regional agency that coordinates state and federal transportation funds for its planning area. Some of the federal transportation funds that can be used for greenway trails are distributed by TPOs/MPOs. Other state and federal transportation funds are distributed by the state DOT. Trails funded by grants from TPOs/MPOs and DOTs generally have to serve a transportation purpose and require a local cash match.

The Tennessee Department of Environment and Conservation (TDEC) distributes grants that can be used for trails and parks. These grants are generally smaller than those distributed by TPOs/MPOs or DOTs. Despite the smaller size of these grants, they are attractive because they sometimes allow an in-kind rather than a cash match, and they often have fewer restrictions and require less time to spend than grants from other state and federal sources.

Private foundations and organizations can be another valuable funding resource. Examples include organizations dedicated to the preservation of specific areas (a river watershed or ridge top), neighborhood boosters, historic or landmark preservation groups, alternative transportation advocates, and habitat preservation groups. Grants from these groups may often be for relatively small amounts of money, but the cumulative effect of multiple grants can have a large impact on a project. Grants may be procured to fund specific portions of a design, such as individual amenities or improved educational signage. Large foundations, such as those with health-related missions, may offer more substantial awards to fund trail construction.

ADVOCACY RESOURCES

BIKE WALK KNOXVILLE
www.bwknox.org

LEGACY PARKS FOUNDATION
www.legacyparks.org

GREAT SMOKY MOUNTAINS REGIONAL GREENWAY COUNCIL
www.smokymountainsgreenways.org

2008 TENNESSEE GREENWAYS AND TRAILS PLAN – APPENDIX B
www.tennessee.gov/environment/recreation/docs/gt_plan2008_app_b.pdf

RAILS-TO-TRAILS CONSERVANCY
www.railstotrails.org

AMERICAN TRAILS
www.americantrails.org/resources/statetrails/TNstate.html

3. IDENTIFY MULTIPLE USES FOR GREENWAY CORRIDORS

GREENWAY CORRIDORS WORK WITH AND SUPPORT ADJACENT USES

When a community invests the time, effort, and funds to build greenways, it should also identify the ways these investments can address other community needs. These new activities and amenities attract visitors such as history buffs, wildlife watchers, naturalists, exercise enthusiasts, agriculture tourists and day visitors, while serving as an economic engine that supports local businesses. It is important to think of a greenway corridor as a means to reach homes, schools, places of worship, landmarks, recreation and conservation areas, and businesses in the trailshed area – and to look for creative ways the transportation routes in the greenway corridor can work together with adjacent land uses.

IDENTIFY LOCATIONS FOR SPECIAL PLACES AND AMENITIES *IN A CORRIDOR*

Landmarks, trailside amenity sites, habitat areas, and other special places help users navigate their way through a trail system and serve as destinations and rest areas. Corridors are often made wider at selected locations to include these features. Some destinations may connect to a primary trail by spur or loop trails that allow a user to explore or linger in the area. These wider areas might accommodate:

- trailside activity places like a micro-park, scenic overlook, water access point, hedgerow, bird or native plant habitat area
- practical elements like restrooms, call boxes, picnic tables or shelters
- "crossroads micro-parks" where two primary trails join

IDENTIFY LOCATIONS FOR SPECIAL PLACES AND AMENITIES *NEAR A CORRIDOR*

Connector trails can link destinations and other areas near a trail that are open to use by greenway users. For example:

- larger adjacent public places, gardens, parks, woodlands, cultural or historic sites that greenway users can enjoy
- wetlands, grasslands, woodlands or habitat provide opportunity to enjoy and learn about native plants and wildlife

Image of Coal Creek Mine entrance. The former rail line between Briceville and Lake City, which served the mine, is being considered for a rail-to-trail project.

TOURS AND THEMES

Every community has stories and traditions – particularly in East Tennessee. Connecting local stories to community greenway corridors and designing routes that bring visitors to memorable or historic sites helps reinforce community character and identity.

For example, the historic coal mining area surrounding Briceville and Lake City once provided coal to power fabric mills in Knoxville, and the area still has many artifacts and sites connected to this history. A railside corridor following the "coal route" could connect locals to their industrial past and bring bicycle tourists north to the Briceville-Lake City area.

IDENTIFY INCENTIVES FOR CONSERVATION OF LANDSCAPE CHARACTER IN ADJACENT LANDSCAPE SETTINGS

Greenway corridors derive a great deal of character from the visual appeal of surrounding landscape setting – this is sometimes referred to as a borrowed view, because the adjacent property owner is essentially allowing visitors to borrow and enjoy the scenery.

During the greenway planning process, a community may consider working with adjacent property owners to identify historic locations, grassland, wetland and floodplain conservation programs that offer incentives or support in exchange for conservation. In such cases, it is important to recognize the need for privacy and safety buffers to shield adjacent landowners from undesirable impacts or trespasses onto private land. Particularly in rural areas, incentive programs applied to woodlots, wetlands, floodplain or low-lying pastures might help families maintain historic family farms.

IDENTIFY INCENTIVES FOR ECONOMIC DEVELOPMENT IN THE TRAILSHED

A community planning a greenway may consider working with property owners in the trailshed to identify economic development opportunities, such as the development of tourism-related businesses. A community may also provide incentives or support for small businesses or startups related to greenway activities, such as renovation credits for historic properties and funding to support festivals and events that attract greenway users.

IDENTIFY POTENTIAL FOR OTHER SERVICES IN BORROWED VIEWS

Some of the benefits of greenway corridors are not immediately evident. For example, an urban or suburban community may be able to avoid expenses for construction of new stormwater management facilities by helping maintain wetlands or floodplains adjacent to waterside greenway corridors under conservation easements. Such areas become visual or recreational amenities and store stormwater after a heavy rain, thus helping mitigate flooding of nearby homes and businesses.

4. IDENTIFY POTENTIAL ROUTES, CORRIDORS AND CONNECTIONS

Greenway corridors are continuous corridors of linear open space where longer primary greenway trails are located. At minimum, a greenway corridor is wide enough to contain the desired mix of trails and their maintenance areas, adequate space for different users, and enough distance to preserve the safety of travelers on the trail and the privacy of adjacent property owners. Greenway corridors often follow existing public open-space, transportation, or utility corridors to take advantage of continuous rights-of-way or easement opportunities that might be arranged in these corridors. With some additional thought, a greenway corridor becomes a linear park that offers amenities to thousands of community residents and visitors.

IDENTIFY LOCATIONS FOR GREENWAY GREEN-SPACE CORRIDORS

To identify opportunities for creating connectivity, greenway planners often assemble regional maps that show existing and planned greenway routes. Then they look for:

- additional routes in each community to connect destinations and neighborhoods to each other and to routes already on the planning map
- routes that have potential to become primary trails that connect communities and destinations across the region

This includes destinations each community identified as significant in Step 1, above. Existing utility, road, rail, and open-space corridors are often considered for greenways because they are both continuous and include connections across community, county, and regional boundaries. Finally, the projected cost and viability of each option is evaluated. Consultations with adjacent property owners, neighborhood groups, and other stakeholders familiar with community needs and landscapes are a key part of a corridor planning process.

IDENTIFY TRAVEL ROUTES AND COMMUNITY CONNECTORS

Routes is a general term planners use to describe the mix of roadways, sidewalks, trails, or even railways and waterways that members of the public use to travel between destinations. For example, the route taken by a person walking her dog may start on a local street or sidewalk in a neighborhood that connects to a greenway corridor, then follow a trail in the greenway corridor to a local dog park.

5. SECURE PLACES FOR TRAILS

As mentioned earlier, greenways often share space in road, railway, utility or waterway corridors or follow property lines. The most common methods for securing passage rights for a corridor are via public rights-of-way (ROW) or easements. The diagrams below show some typical locations for trails in relation to different types of easements and rights-of-way.

Right-of-Way (ROW): Land held in fee simple title for use as a public utility (highway, road, railroad, trail, utilities, etc.) for a public purpose. Usually includes a designated amount of land on either side of the utility that serves as a buffer for adjacent land uses.

Easement: Grants the right to use a specific portion of land for a specific purpose or purposes. Easements may be limited to a specific period of time or may be granted in perpetuity; or the termination of the easement may be predicated upon the occurrence of a specific event. An easement agreement survives transfer of land ownership and is generally binding upon future owners until it expires on its own terms.

Road Diet: A technique in transportation planning whereby the number of travel lanes and /or effective width of the road is reduced in order to improve safety or provide space for other modes of travel within the road right-of-way.

ROADSIDE LOCATIONS (A)

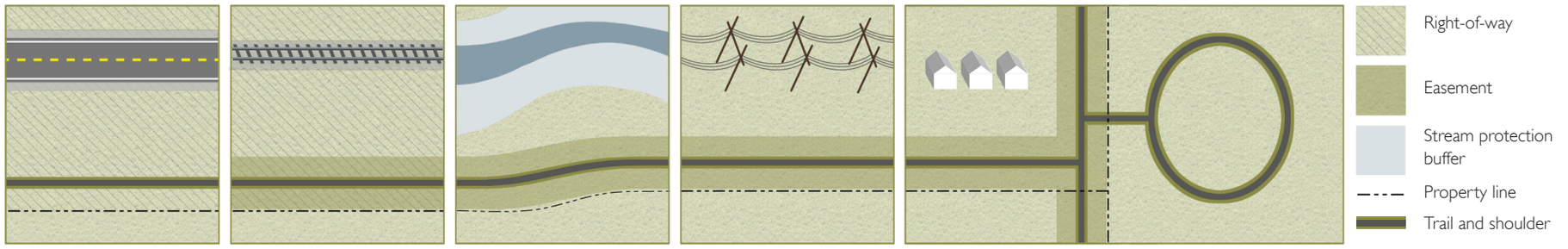
If sufficient space is available, roadside greenway routes are often located in road rights-of-way, and safety barriers and buffers, shading, signage, lighting for the trail are integrated with the roadway corridor design. Sometimes innovative approaches like **road diets** are used to fit a greenway into a road right-of-way. However, if space cannot be made available in the road ROW, easements or additional ROW may be sought from adjacent property owners. Depending on the road's context and the types of bicyclists expected, bicycle lanes or bikeable shoulders may also be integrated into the road design.

RAILSIDE LOCATIONS (B)

Permission to build a trail within in a railroad ROW is obtained from the rail company, and the private owner typically retains ownership of the land. Whether the trail is within the railroad ROW or in a separate easement, the greenway is usually located as far away from the tracks as possible. Grade changes, dense plantings, fences and other barriers should be included to stop greenway users from trespassing on the rail line. Buffers, fences or other barriers may also be needed to prevent trespass of users onto property adjacent to the railroad ROW and to create privacy for adjacent property owners. Greenways corridors should be located to minimize crossings of active rails at grade.

If a rail company will not grant permission to use their ROW, a community may explore options with adjacent property owners (see E).

TYPICAL LOCATIONS FOR TRAILS: RIGHTS-OF-WAY AND EASEMENTS



(A) Roadside locations (B) Railside locations (C) Waterside locations (D) Utility corridors (E,F) Adjacent to Property lines and in Open Spaces

WATERSIDE LOCATIONS (C)

Trail easements may include the waterside or leave that area under private control. However, waterside greenway routes are always located at a distance from the bank of the waterway. This achieves several purposes. Trails at the outer edge or outside a waterway floodplain:

- are less prone to damage and erosion caused by flooding
- remain dry and passable for more of the year
- minimize impacts that damage and erode waterway banks
- avoid disruption of waterside nesting sites

A native vegetation buffer area can be created adjacent to waterway banks to help stabilize stream banks, improve scenic value, and provide scenic habitat. Areas of lower vegetation in this buffer area allow water views from the trail. Spurs or loops off of the main trail can bring greenway visitors up to the water's edge at specified locations. Access points for waterside trails should be carefully selected for scenic value and minimal impact on the waterway.

UTILITY CORRIDORS (D)

Trails in utility corridors often have an easement separate from the utility easement. Such easements may be granted under high lines or at the outside edge of a sewer or waterline easement. Greenway route locations must comply with separation distances and overhead clearances specified by the utility company. Avoid locating trails directly over underground utilities, as utility maintenance activities may damage the trail. Find out whether utility maintenance vehicles will use the trail for access and design the trail accordingly. Grade changes, plantings, fences and other barriers should be included to stop greenway users from trespassing into areas of ROW beyond the easement. Buffers, fences, or other barriers may also be needed to prevent trespass of users onto property adjacent to the utility ROW and create privacy for adjacent property owners. Make sure to include requests for any passages across utility corridors that planned routes might require.

If property owners in a utility corridor will not grant easement, a community may explore options with other adjacent property owners (see E).

ADJACENT TO PROPERTY LINES (E)

Typically property owners prefer to locate easements adjacent to a property line. Buffers, fences or other barriers may be needed to prevent trespass of users onto private property and create privacy for adjacent property owners. Property owners often use an area of trees, shrubs or hedgerow to mark the edge of private property.

Carefully evaluate existing vegetation at property lines to see if it has value for privacy screening or bird habitat before clearing for greenway routes. Make sure that easements are generous enough to allow for planned routes, maintenance areas, buffers, barriers, and separation areas required for the safety of corridor users and the privacy of adjacent property owners on both sides of the corridor.

OPEN SPACE (F)

Open spaces are often destinations in a greenway system because of the recreational and social activities they offer. When corridors pass through open spaces owned or accessible to public use, such as a public park or waterfront plaza, opportunities exist to add spurs, loops, and other trail configurations that provide users more variety of route choices and experiences. One or two simple connectors can link trails in open spaces to a nearby greenway corridor system, increasing use and accessibility of both the open space and the corridor.

6. PLAN FOR CONNECTION, ACCESS, AND VARIETY OF ROUTES

IDENTIFY POTENTIAL CONNECTORS, ACCESS POINTS, AND TRAILHEADS

While a greenway corridor may have an overall character that unites segments into a continuous whole, trail routes are often divided into a series of shorter trail segments for design, management, and maintenance purposes. These segments can differ significantly as the trail passes through different landscape settings, soils, terrain, land uses, and other features. Individual segments of the same trail may simply be basic links that connect over a long distance, or they may each have a distinct character. A segment may be a special place that requires a different layout, material palette, and amenities than the rest of the trail to accommodate an increased intensity of use or a greater variety of available experiences.

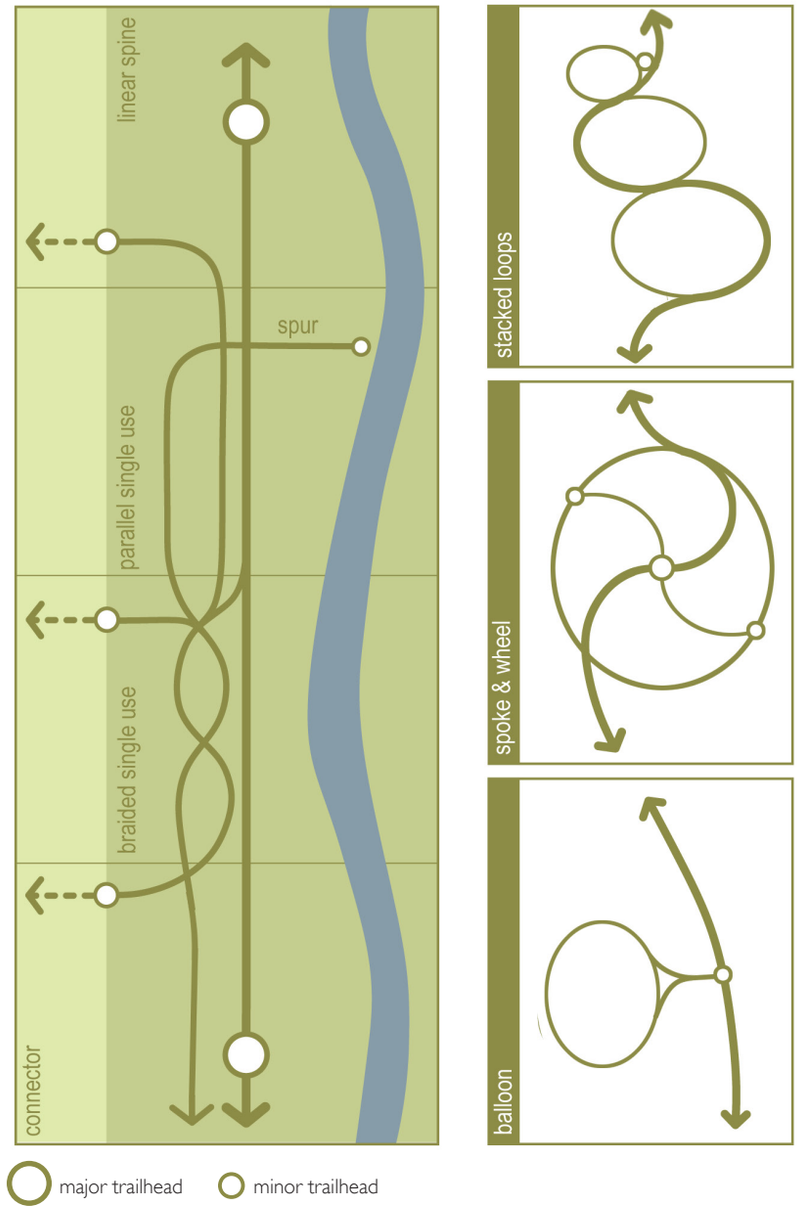
VARIETY MAKES GREENWAY TRAVEL INTERESTING

As the old saying goes, "variety is the spice of life." A great greenway system may include both direct **linear spine trails** to help a user get to a destination and areas of **parallel, braided,** and **spur trails** off the main spine that allow frequent or recreational visitors a variety of routes in and around the corridor. It is not necessary to always pave alternate route spurs and byways off the main trail – especially if they are designed to be less traveled or they bring wildlife watchers into quieter, more fragile landscapes. Other trail layout variations, such as stacked loops, spoke and wheel, and balloon trails, are also illustrated at the right.

Once potential corridor and trail routes are identified, connectors and trailhead options for each route should be considered. The more connections a corridor has to homes, employment locations, and other destinations, the more it will be used. A **connector** is a part of the route that is not in the greenway corridor, but helps local residents reach entries to the corridor. A **spur** is a short trail within the greenway corridor that leads from a primary, spine, or secondary trail to points of user interest – overlooks, waterside access points, etc.

Minor trailheads are entry points that help local residents access greenways from home and other destinations without driving – for example from a sidewalk or residential street. These trailheads usually do not include parking areas, lighting or other amenities that may be disruptive to a residential area. **Major trailheads** are more publicly accessible locations where people have the option of driving to the greenway and parking. These trailheads are usually located adjacent to roads or near existing parking that a school, place of worship, park, or community-minded business is willing to share. Sponsoring a trailhead often increases foot traffic for adjacent businesses. All trailheads should include signage to raise awareness of the trail and to help orient users.

GREENWAY SYSTEM TRAIL LAYOUTS



7. DETERMINE TRAIL SURFACE TYPE AND LOCATION

DIFFERENT ACTIVITIES REQUIRE DIFFERENT SURFACE MATERIALS

People pursue activities as diverse as bird watching, commuter bicycling, mountain biking, jogging, walking, and horseback riding in the same greenway corridor.

To maintain the safety and enjoyment of all greenway users, it is a good practice to provide separated trail surfaces for incompatible activities and travel modes. Whenever possible, trails should be designed for ADA accessibility, especially when public funds or lands are used.

Noise, conflicts between users, wear and tear, frequency of use, terrain requirements and travel speed are some of the factors that determine compatibility of uses and modes in greenway corridors and thus the number and arrangement of single-use and multi-use trail surfaces required in each corridor segment.

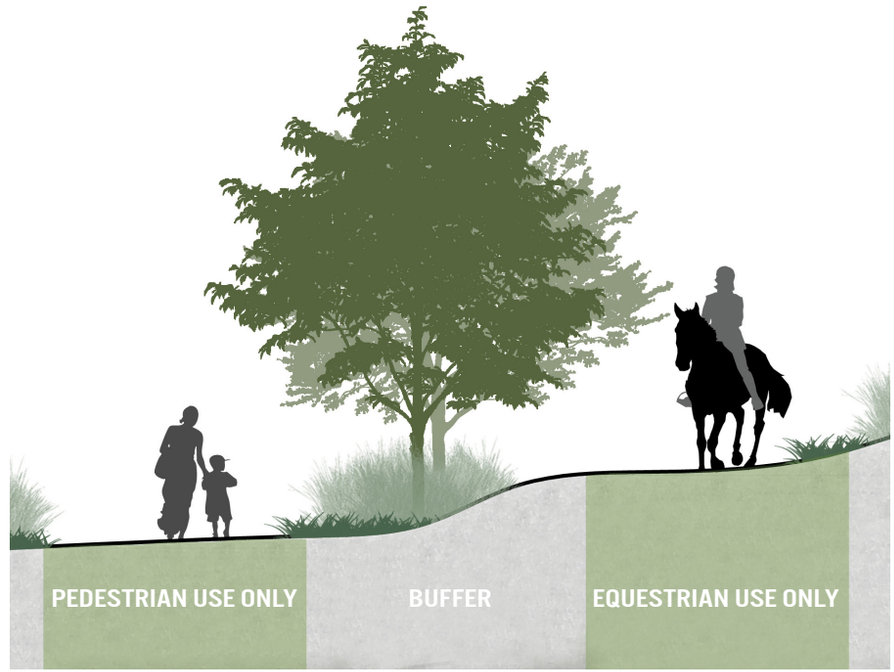
Trail surface is the actual surface in the greenway corridor where people walk, ride, or roll, while a trail bed is the finished earth surface on which a base course or surfacing may be constructed. For trails without surfacing, the trail bed is also the surface. Care should be taken to avoid damage roots of trees and shrubs when preparing a trail bed.

TRAIL SURFACES

If needed, separate trail surfaces for different users can be placed within the same corridor. In these cases vegetation buffers, distance, or changes in elevation are used to separate incompatible trail uses (see illustration at right). In addition, slopes, turning radii, stopping distances, trail bed, maintenance area, signage, lighting and other factors may vary by the modes of travel a trail is designed to accommodate. (See Visual Index B in Part III of this guide.)

Greenway design professionals help a community make sure that its greenways meet all code requirements and are designed with the same care, thought, and concerns for safety, durability, and maintenance needs as its roads.

Professional Greenway Design Services: Design and layout of greenway trails and systems requires special training, knowledge, experience, and skill. Many different factors are taken into account, including hydrology, topography, soils, flora, fauna, management objectives, user expectations and characteristics, and trail design standards. Greenway designers utilize data collected from area site analysis, environmental assessments, public meetings, and area trail and management plans.



SEPARATED SINGLE-USE TRAILS

Minimum horizontal buffer will differ from site to site. Consider installing a barrier when horizontal separation is not available.

MIXED-USE TRAIL SURFACES

Sometimes, different types of trail users share the same trail surface. For mixed-use transportation trails, the AASHTO Guide for the Development of Bicycle Facilities sets the standard minimum trail width at 10 feet. In instances where there is a significant constraint, a width of 8 feet may be allowed for short distances. If a particular area is expected to be highly used, then a width of 11 to 14 feet should be considered.

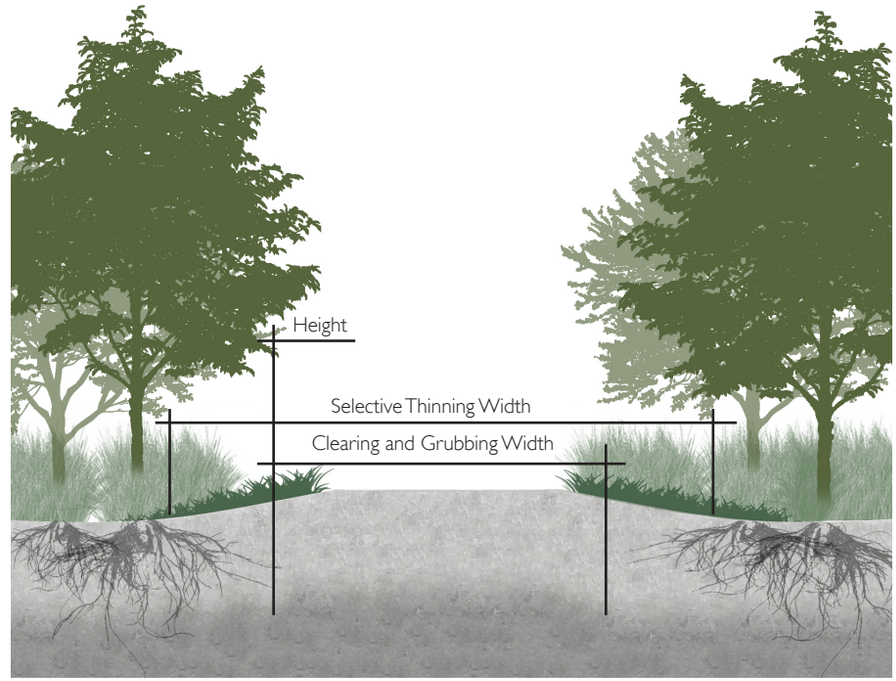
8. CONSIDER MAINTENANCE AND BUFFER AREAS

Like road corridors, greenway corridors have maintenance areas where routine maintenance occurs to keep a trail passable, including all cleared and managed parts adjacent to the surface. A maintenance area typically includes the full dimensions of the path or trail surface, an adjacent area (2 feet minimum) on either side of the trail where vegetation is kept low, and the space overhead (often 10 to 12 feet) from which brush and obstacles need to be cleared.

Well-designed greenway corridors minimize maintenance needs through:

- minimizing the width and height of maintained areas
- locating trail surfaces on stable sub-surface conditions with minimal flooding
- selecting trail surface and trail bed materials appropriate for slopes and soils
- using native plant materials that minimize mowing, trimming, and other care requirements

Visual Index sections of this document provide more information on many of the topics discussed in this section.



GENERAL CLEARING, GRUBBING, AND THINNING WIDTH AND HEIGHTS

The clearing and grubbing width, as well as the selective thinning width, should be determined by the width of the trail:

TRAIL WIDTH	CLEARING AND GRUBBING WIDTH	SELECTIVE THINNING WIDTH
6 FOOT	10 FEET	20 FEET
8 FOOT	14 FEET	24 FEET
10 FOOT	16 FEET	26 FEET

The clearing height should be based on the "tallest" user type expected on that particular trail. If pedestrians and hikers are the only users expected, then the clearing height is 8 feet. When bikes will also use the trail, the clearing height is 10 feet. In cases where trails permit equestrian use, the clearing height is 12 feet.

PART 1 // RESOURCES

REFERENCES

BOOKS AND PUBLICATIONS

2010 American Disabilities Act (ADA) Standards for Accessible Design

American Association of State Highway and Transportation Officials (AASHTO) Guide for the Development of Bicycle Facilities

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Flink, Charles and Kristine Olka, Robert Searns, Rails to Trails Conservancy, David Burwell (Foreward) Trails for the Twenty-First Century: Planning, Design, and Management Manual for Multi-Use Trails. Island Press; REV edition, 2001

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Hellmund, Paul Cawood and Daniel Smith. Designing Greenways: Sustainable Landscapes for Nature and People. Island Press; 2nd edition, 2006

Steinholz, Robert T. with Brian Vachowski and USDA Forest Service. Wetland Trail Design and Construction. Publisher: lulu.com, 2013

Trail Construction and Maintenance Notebook, USDA, Forest Service, 2007

WEBSITES

Council of Bay Area Resource Conservation Districts, Horse Owners Guide to Water Quality Protection
atfiles.org/files/pdf/HorseOwnersGuide.pdf

Equestrian-Related Water Quality Best Management Practices
atfiles.org/files/pdf/Equestrianwatermgmt.pdf

Great Smoky Mountains Regional Greenway Council:
smokymountainsgreenways.org/aboutgw.htm

National Trails Training Partnership, Planning Trails & Greenways:
www.americantrails.org/resources/planning/index.html

National Trails Training Partnership, Trail Design and Construction:
www.americantrails.org/resources/trailbuilding/index.html

Tennessee Trails & Tracks Resource Guide
www.tennessee.gov/environment/recreation/docs/trails-tracks-resource-guide.pdf

United States Access Board:
www.access-board.gov

VOCABULARY RESOURCES

American Trails glossary of terms:
www.AmericanTrails.org/resources/info/glossary.html

United States Department of Transportation dictionary:
www.rita.dot.gov/dictionary/index.xml

GLOSSARY TERMS

Bank
The terrain alongside the bed of a river, creek, or stream. The grade of the bank can vary from nearly vertical to a shallow slope.

Floodplain
Flat, occasionally flooded areas bordering streams, rivers, or other bodies of water, susceptible to changes in the surface level of the water. The Federal Emergency Management Agency (FEMA) maintains floodplain maps for many waterways in the United States.

Floodway
The channel of a river or stream where the annual rising or lowering of water occurs.

Greenway Corridor
A linear open space containing the greenway trail and maintenance area; may include environmental, safety, and privacy buffer areas. Often found along existing contiguous open spaces such as road and rail rights-of-way, and waterway and utility easements. Can provide space for conservation, recreation, alternative transportation, and wildlife habitat.

Greenway System
A set of greenway corridors, trails and associated accesses that interconnect and function as a whole to serve community, county or regional users. Each trail retains its local distinctiveness and character; however, some elements like signage may be similar or standardized to help users find their way through the system. Greenway systems can connect parks, wilderness preserves, cultural facilities, and historic sites with business, residential, and rural areas.

Multiple-Use (Multi-Use, Shared-Use) Trail
Includes a single, braided or parallel set of trails that interconnect and are designed to support more than one user group at a time (for example, pedestrian and bicyclists). Some user groups may still be excluded.

Professional Greenway Design Services
Design and layout of greenway trails and systems requires special training, knowledge, experience, and skill. Many different factors are taken into account, including hydrology, topography, soils, flora, fauna, management objectives, user expectations and characteristics, and trail design standards. Greenway designers utilize data collected from area site analysis, environmental assessments, public meetings, and area trail and management plans.

Right-of-Way (ROW)
Land held in fee simple title for use as a public utility (highway, road, railroad, trail, utilities, etc.) for a public purpose. Usually includes a designated amount of land on either side of the utility that serves as a buffer for adjacent land uses.

Road Diet
A technique in transportation planning whereby the number of travel lanes and/or effective width of the road is reduced in order to improve safety or provide space for other modes of travel within the road right-of-way.

Single-Use Trail
Includes trail surfaces designed, constructed, and signed for only one intended use – for example, hiking.

Stream Protection Buffer
An area of preserved or restored vegetation to either side of a waterway designed to slow stormwater, and to allow for sediment dropout and debris removal before runoff enters the waterway. In a stream protection buffer, the roots of dense native vegetation stabilize stream bank soils while leaf canopy cover regulates temperature and provides wildlife habitat. Measures should be taken during trail construction adjacent to waterways to preserve and remediate vegetation. Once established, streamside vegetation should not be mown. For more information on minimum stream protection buffer areas and measures refer to: Knox County Tennessee Stormwater Management Manual, Chapter 6: Water Quality Buffers. Regulations vary by jurisdiction.

Trail Community
Those with an interest in, or relationship to, a particular trail, such as trail users, volunteers, landowners, and the officials and citizens of local communities through which the trail passes. The Appalachian Trail Community is an example.

Trail Easement
Grants the right to use a specific portion of land for a specific purpose or purposes. Easements may be limited to a specific period of time or may be granted in perpetuity. Alternatively, the termination of the easement may be predicated upon the occurrence of a specific event. An easement agreement survives transfer of landownership and is generally binding upon future owners until it expires on its own terms.

Trail Route
An established or selected course of travel along a greenway trail.

Trail Segment
To make design, management and maintenance easier, long trails are sometimes divided into segments. Changes in geographic features, trail surface layout, jurisdiction and/or political boundaries are often used to distinguish segments.

Trail Spur
A trail that leads from primary, secondary, or spine trails to points of user interests or activities – overlooks, waterside access points, etc. Spurs are contained within the greenway corridor.

Trail Surface
The actual surface in the greenway corridor where people walk, ride, or roll, while a trail bed is the finished earth surface on which a base course or surfacing may be constructed. For trails without surfacing, the trail bed is also the surface. Care should be taken to avoid damage roots of trees and shrubs when preparing a trail bed.

Trail, Primary
A continuous route that originates at or connects to trailheads and serves as a major route through a community or regional greenway system. Primary trails direct users through an area. Ideally, primary trails also connect a number of significant destinations to each other – like freeways and arterials do in our road system.

Trail, Secondary
Shorter trails that create connections between primary trails or branches of primary trails. Secondary trails encourage local movement between two primary trails or create a variety of routes for exploring a localized area.

Trail, Spine
A spine is a trail that acts as a "backbone" to a regional trail system. Regional spine trails are also often primary trails in community, county and regional greenway systems.

Trail
A single trail or set of braided or parallel trails that interconnect and are designed to support trail activities, plus adjacent maintenance and buffer areas in the corridor. Where rights-of-way or easements are narrow, the trail may use much of the width of a greenway corridor. In other areas, a greenways corridor may include the trail corridor plus trailside feature or amenity areas.

Trailshed
The geographical area and population from which a greenway trail attracts users or visitors.

Travel mode
A particular form of travel, such as walking, bicycling, operating a motor vehicle, etc.

PART 2 // EXAMPLE LANDSCAPES

HOW TO USE PART II
EXAMPLE LANDSCAPES

Part II of this guide builds on the basics of trail layout, design, and location that are outlined in Part I. The ridge and valley terrain that give East Tennessee much of its natural beauty also make the task of finding continuous routes for greenway corridors a difficult one. Often, the most successful strategy is to share space with an existing road, rail, or utility corridor, or to follow the natural corridor created by a stream or river. The trail examples in Part II are divided into three sections: one focusing on roadside trails, one on railside trails, and one on waterside trails. To reflect the diversity of development patterns found in East Tennessee, examples are illustrated in settings with rural, suburban residential, suburban commercial, and urban characters.

Readers who are advocating for or studying the feasibility of a potential greenway corridor should start by looking at the table of contents to identify example landscapes in Part II that most closely relate to their own situation. Keep in mind that greenway corridors may wind their way through multiple types of landscapes – for example, following a rural road, then transitioning to a streamside path when the greenway reaches a more heavily developed area – so readers may find themselves referencing more than one section in Part II.

Each example landscape is presented on a two-page spread with an axonometric view of the representative trail in a landscape context on the left-hand page and a written description, photo, and more technical information on the right-hand page. The axonometric view helps the reader understand the relationship between the trail and the road or rail right-of-way, or the streamside flood plain and water-quality buffer. Down the right side of the spread, six shaded bars direct the reader to the specific items in the Visual Indexes (Part III of this Guide) that relate to this example landscape condition. The reader can then check Visual Indexes A through F for more detailed information on infrastructure used for crossings, surface materials, signage, barriers & buffers, lighting, and trail-side amenities.

PART 2 // TABLE OF CONTENTS

ROADSIDE TRAILS

INTRODUCTION

Cities and towns looking to increase walking and bicycling can leverage the traffic volume and visibility of existing motorways by constructing roadside trails.

One of the challenges in greenway planning is identifying easements or rights-of-way that can accommodate trails. Roadside trails, also called sidepaths, are often viable within the existing right-of-way adjacent to the street.

Roadside trails provide the same benefits as the streets they accompany, such as connecting retail, employment centers, neighborhoods, schools, and other places. When the design challenges are addressed with clear signage and safe intersections, sidepaths can provide robust networks for bicycling and walking.

OPPORTUNITIES FOR ROADSIDE TRAILS

Rights-of-way along existing roads often allow room for a parallel greenway trail and buffer. Roadside trails are appropriate when no independent right-of-way is available or for bridging gaps between other greenways. In general, the more intersections and driveways there are along a road, the less ideal it is for a sidepath. The Sidepath Checklist (Appendix D) can help you determine whether a sidepath or bike lane is appropriate for a given location.

Roadside trails share the benefits that come with proximity to high-traffic thoroughfares. Studies have shown that trail usage increases in areas of higher population with mixed land use and easy access to schools, retail centers, and public transit. Where existing motorways connect these desirable nodes, parallel greenway trails will likely get more use.

Roadside trails must be planned according to the type of road they accompany. Controlled-access, limited-access, and open-access roads can each host successful roadside trails when the proper design strategies are employed.

TRAILS ALONG CONTROLLED-ACCESS ROADS

Controlled-access roads, including freeways and interstates, offer two strong benefits for roadside trails – large rights-of-way and few intersections. Trails along such roads especially benefit bicycle commuters. Design obstacles include the need to separate the trail from high-speed motor vehicle traffic and maintaining trail continuity and safety around grade-separated interchanges.

TRAILS ALONG LIMITED-ACCESS ROADS

Limited-access roads include local highways and arterial roads with relatively high travel speeds, fewer intersections than other surface streets, and features that limit access, such as medians. They share some of the benefits of controlled-access roads, and are often constructed on grade so continuity around overpasses and on-ramps is not a concern. Buffers between the trail and the street are preferred, and places where the trail crosses intersections and driveways require careful planning.

TRAILS ALONG OPEN-ACCESS ROADS

Open-access roads are surface streets with frequent driveways and intersections, and no medians to limit access points. When they are made safe for pedestrians and bicyclist, they offer easy access to daily destinations, including school, work, and the grocery store. If motor vehicle speeds are relatively low and intersections and driveways are not too frequent, a sidepath may work. Intersections and driveways must be handled with careful signage and design. If a sidepath is not appropriate, consider other bicycle and pedestrian accommodations, such as sidewalks and bicycle lanes.

COMMON CHALLENGES

Anytime motorists, bicycles, and pedestrians travel in close proximity, there is the potential for conflicts. Intersections and driveway crossings that include sidepaths must be carefully planned to include proper sight lines and appropriate signage and signals. Greenway trails usually accommodate travel in both directions, which can confuse motorists who are not accustomed to checking for oncoming traffic to their right.

Extra care must be taken at the ends of roadside greenways so that cyclists do not enter a roadway against the direction of travel. Roadside greenways should terminate in low- or slow-traffic neighborhood streets, into bike lanes or routes, or into other networks of trails.

BUILDING ROADSIDE TRAILS

The first step in constructing roadside trails is to determine who controls the right-of-way. Trail advocates will work with the controlling agency to determine whether the road is a suitable candidate for a parallel greenway. Considerations include right-of-way size, traffic speed and volume, and average distance between intersections with cross streets.

Roadside greenways require a buffer between the motor vehicle travel lanes and the greenway. The ideal buffer width will vary based on context. High-speed roads require additional buffer space. Where space is limited, physical barriers may be constructed between the motorway and greenway in place of a buffer.

Different surface materials may be considered for use on roadside greenways. Initial installation expense should be weighed against long-term maintenance costs. Some surfaces have low initial cost, but require regular maintenance (see Visual Index B on surface materials).

REFERENCES

AASHTO Guide for the Development of Bicycle Facilities

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Portland Parks & Recreation. "Trail Design Guidelines for Portland's Public Park System." Accessed November 3, 2013, at atfiles.org/files/pdf/PortlandTrailDesign.pdf


BEFORE
ANDERSON COUNTY, TN

AFTER // RURAL ROAD

BEFORE
LOUDON COUNTY, TN

AFTER // SUBURBAN RESIDENTIAL ROAD

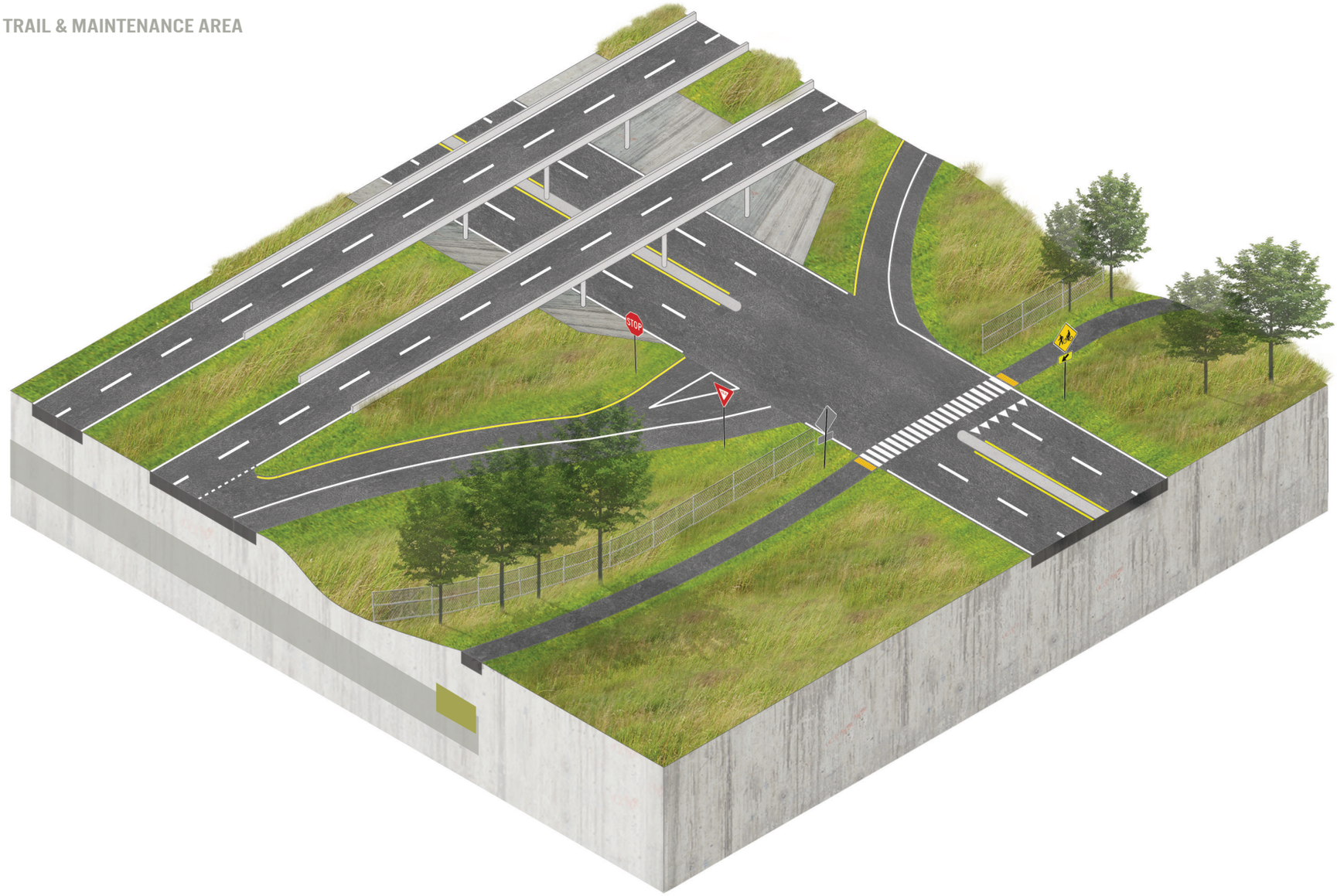
BEFORE
ANDERSON COUNTY, TN

AFTER // SUBURBAN COMMERCIAL ROAD

CONTROLLED-ACCESS // RURAL

VARIABLE ROAD RIGHT-OF-WAY

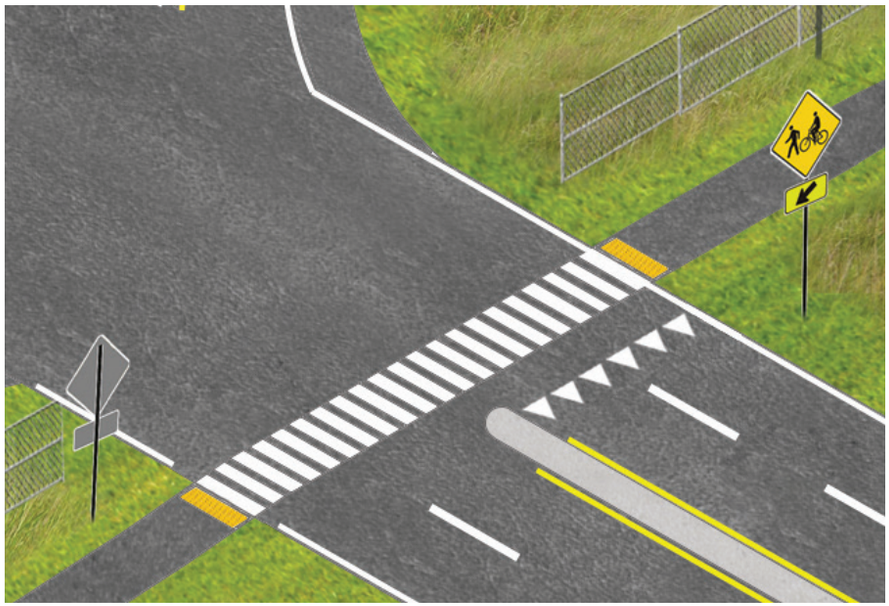
TRAIL & MAINTENANCE AREA



RURAL TRAILS ALONG CONTROLLED-ACCESS ROADS

Controlled-access roads, including freeways and interstates, located in a rural setting typically have large rights-of-way and few intersections, making them ideal for roadside trails. The contiguous stretches of land found within the controlled-access right-of-way can help these trails to link communities with each other. Trails along such roads especially benefit bicycle commuters.

Trails along controlled-access roads should maximize the buffer zone separating the trail from the high-speed motor vehicle traffic and should include a physical barrier such as a fence. To maintain trail continuity and safety at grade-separated interchanges, the trail should be pulled as far away from the on/off ramp as possible to allow a motorist to have clear sight lines and ample stopping distance to the trail crossing.



A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE/RECREATIONAL
B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
C2 SAFETY/AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY

D BUFFERS
D3 BARRIERS/TRESPASS/FENCE

E LIGHTING
E2 ROADWAY CROSSING

F AMENITIES
F6 REST + SHELTER/SHADE

CONTROLLED-ACCESS // URBAN & SUBURBAN

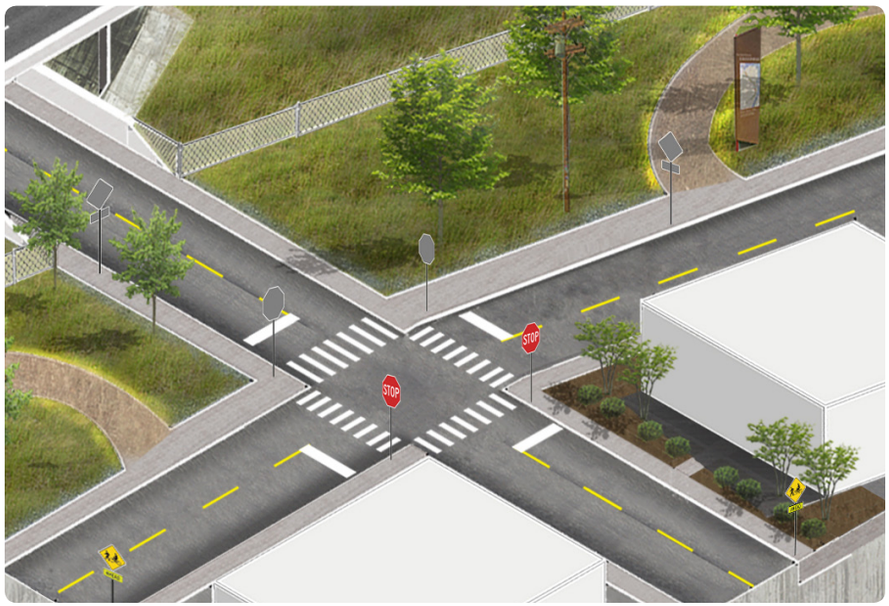
VARIABLE ROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA

URBAN & SUBURBAN TRAILS ALONG CONTROLLED-ACCESS ROADS

Controlled-access roads in urban areas offer contiguous stretches of land that may serve as helpful connections between longer suburban trails and offer access to the greenway system for adjacent communities. These roads in urban locations typically have more restricted right-of-ways than controlled-access roads in suburban or rural locations.

Physical barriers should be used between the trail and the high-speed motor vehicle traffic, given the smaller width of the right-of-way. At intersections located beside grade-separated interchanges, the trail may need to merge with the sidewalk or bike lane on an adjacent local street. In cases such as this clear signage should be provided to the greenway user.



A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE
B4 TRAIL SIDES/LEVEL AREAS

C SIGNAGE
C2 AT DRIVER/AT GREENWAY USER
C2 WAYFINDING/ON GREENWAY
C4 HISTORICAL AND EDUCATIONAL

D BUFFERS
D3 BARRIERS/TRESPASS/FENCE
D4 BORDERS/SPECIMEN PLANTINGS

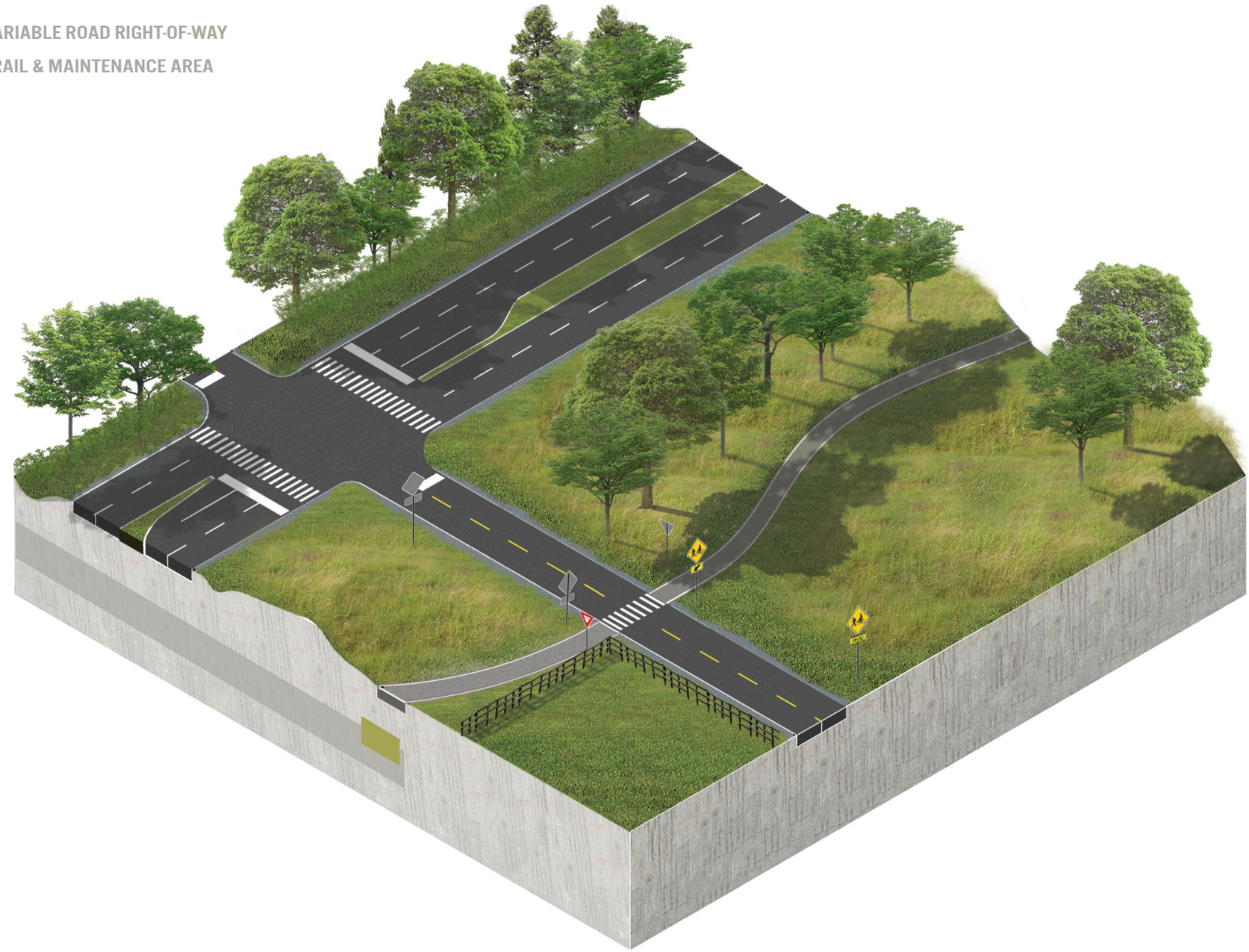
E LIGHTING
E2 URBAN TRAIL

F AMENITIES
F2 ART/LEARNING/COMMERCIAL
F3 SANITATION/WASTE
F5 REST + SHELTER/SEATING/SHADE

LIMITED-ACCESS // RURAL

VARIABLE ROAD RIGHT-OF-WAY

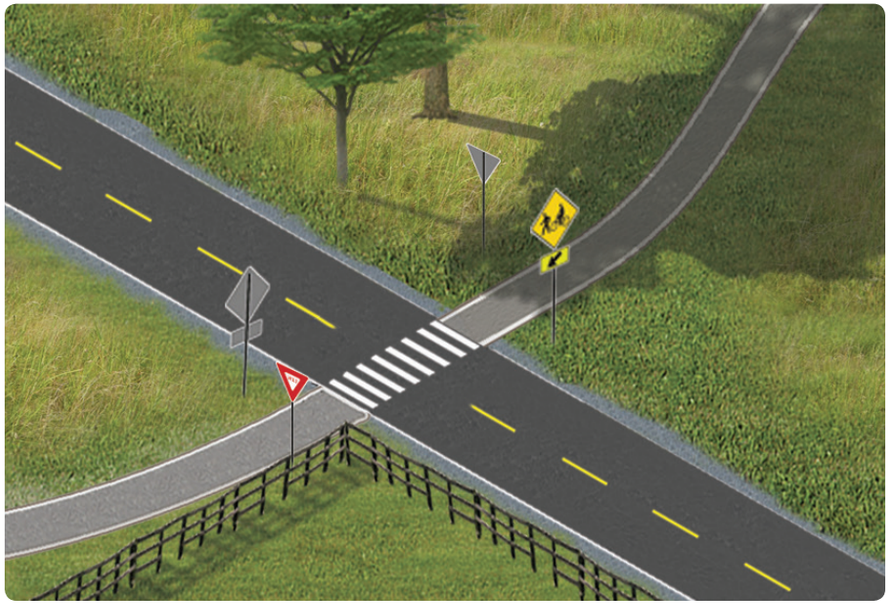
TRAIL & MAINTENANCE AREA



RURAL TRAILS ALONG LIMITED-ACCESS ROADS

Limited-access roads in rural areas typically include local highways and arterial roads that have fewer intersections than other surface streets and frequently have features that limit access, such as medians. Since limited-access roads are primarily constructed on grade, trail continuity around overpasses and on ramps is not a concern. Trails along these rights-of-way can help link communities together and provide access to recreational resources and retail locations.

Buffers between the trail and street are preferred. To maintain safety where a trail crosses a street near an intersection, the trail should be pulled back from the intersection to allow a motorist to have clear sight lines and ample stopping distance to the trail crossing.



A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE/RECREATIONAL
B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
C2 SAFETY SIGNAGE/AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY

D BUFFERS
D4 BORDERS/SPECIMEN PLANTINGS

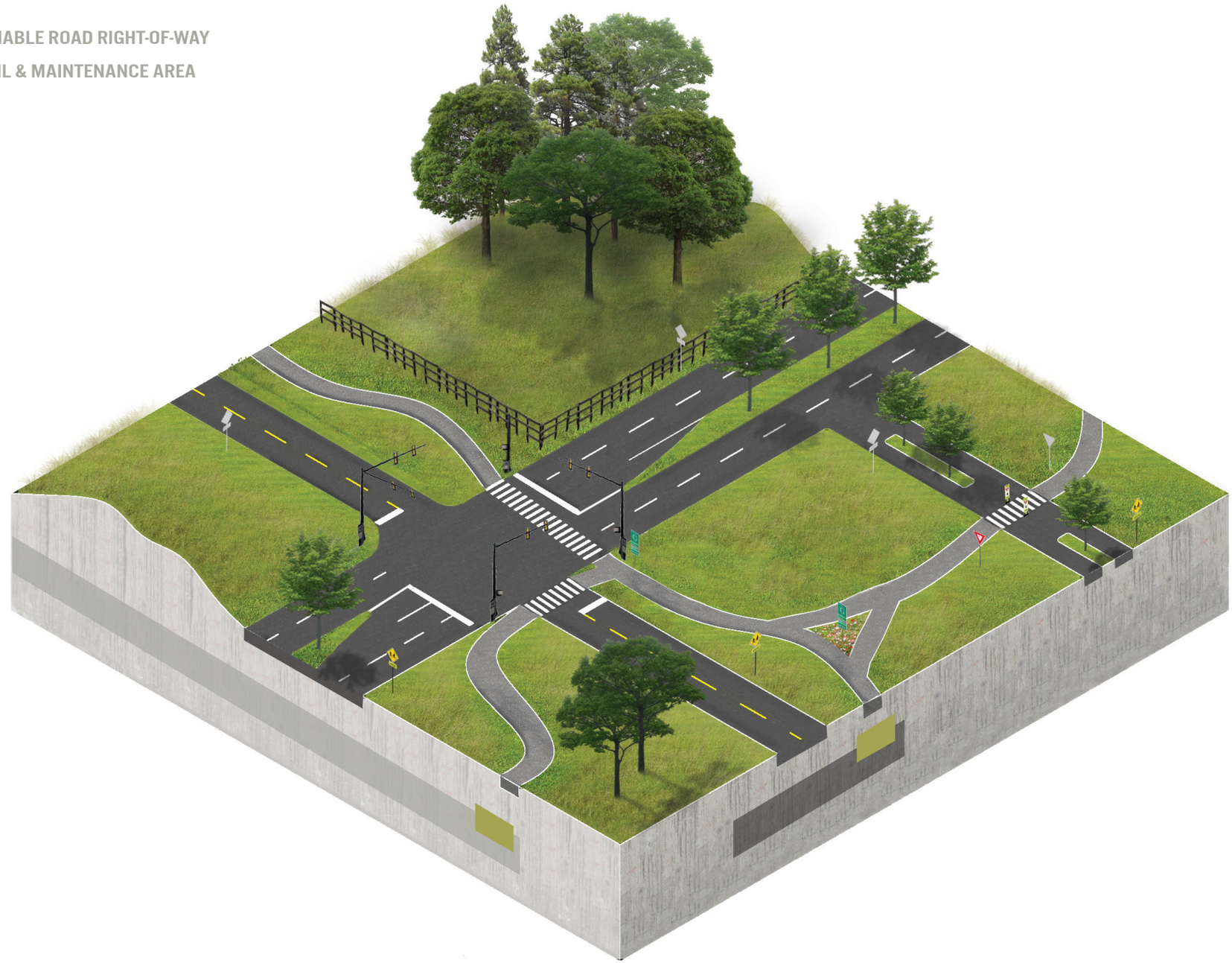
E LIGHTING
E2 ROADWAY CROSSING

F AMENITIES
F5 REST + SHELTER/SHADE

LIMITED-ACCESS // SUBURBAN

VARIABLE ROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA



SUBURBAN TRAILS ALONG LIMITED-ACCESS ROADS

Limited-access roads in suburban areas typically include local highways and arterial roads that have fewer intersections than other surface streets and share many of the benefits of limited-access roads in rural locations. These benefits include features that limit access, such as medians, and on-grade intersections. Trails along these rights-of-way in suburban locations can provide users with access to retail locations, employment centers, neighborhoods, and schools.

Buffers between the trail and street are preferred. Intersections in suburban locations often have traffic lights that can be adjusted to allow trail users adequate time to cross the road. Ample signage and clear sight lines should be provided so that motorists have a clear view of the trail crossing.

A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE
B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
C2 AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY
C4 HISTORICAL AND EDUCATIONAL

D BUFFERS
D3 BARRIERS/TRESPASS/FENCE
D4 BORDERS/SPECIMEN PLANTINGS

E LIGHTING
E2 ROADWAY LIGHTING

F AMENITIES
F5 REST + SHELTER/SHADE

OPEN-ACCESS // SUBURBAN COMMERCIAL

VARIABLE ROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA

SUBURBAN TRAILS ALONG OPEN-ACCESS COMMERCIAL ROADS

Open-access roads in suburban commercial areas are surface streets with multiple driveways and intersections. They can be viable locations for greenway trails if the motor vehicle speeds are relatively low and intersections and driveways are not too frequent. When they are made safe for pedestrians and bicyclists, they offer easy access to daily destinations, including school, work, and the grocery store.

Use the Sidepath Checklist (Appendix D) to determine whether a roadside trail is appropriate. If a sidepath is not the right choice, consider other bicycle and pedestrian accommodations, such as bicycle lanes and sidewalks.

Planted buffers should be provided between the trail and the road. Careful consideration must be given to ensure the buffers are low enough to provide clear sight lines between motorists and trail users. Intersections and driveways must be handled with careful signage directed at drivers, pedestrians, and cyclists.

A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE
B4 TRAIL SIDES/LEVEL

C SIGNAGE
C2 AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY
C4 HISTORICAL AND EDUCATIONAL

D BUFFERS
D3 BARRIERS/SAFETY /CURB + BOLLARDS
BORDERS/SPECIMEN PLANTINGS
D4 COORDINATED MATERIALS

E LIGHTING
E2 URBAN TRAIL

F AMENITIES
F2 ENRICHMENT/ART/COMMERCIAL
F3 BIKE PARKING/BIKE REPAIR
F4 WELFARE + SANITATION
F5 REST + SHELTER
F6 POCKET PARKS

OPEN-ACCESS // URBAN

VARIABLE ROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA

URBAN TRAILS ALONG OPEN-ACCESS ROADS

Open-access roads in urban areas are surface streets with frequent intersections and driveways. These roads can be attractive locations for sidepath trails due to their low motor vehicle speeds and high concentration of daily destinations such as shopping, schools, grocery stores, and neighborhoods. Often, urban trails can become valuable links for commuters between longer suburban or rural trails.

Use the Sidepath Checklist (Appendix D) to determine whether a roadside trail is appropriate. If a sidepath is not the right choice, consider other bicycle and pedestrian accommodations, such as bicycle lanes and sidewalks.

Planted buffers should be provided between the trail and the parallel parking spots or vehicle travel lanes. Parking spots should be set back from intersections so that parked cars do not block sight lines between motorists and trail users. Careful consideration should be given to signage at intersections and driveways.

A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE
B4 TRAIL SIDES/LEVEL

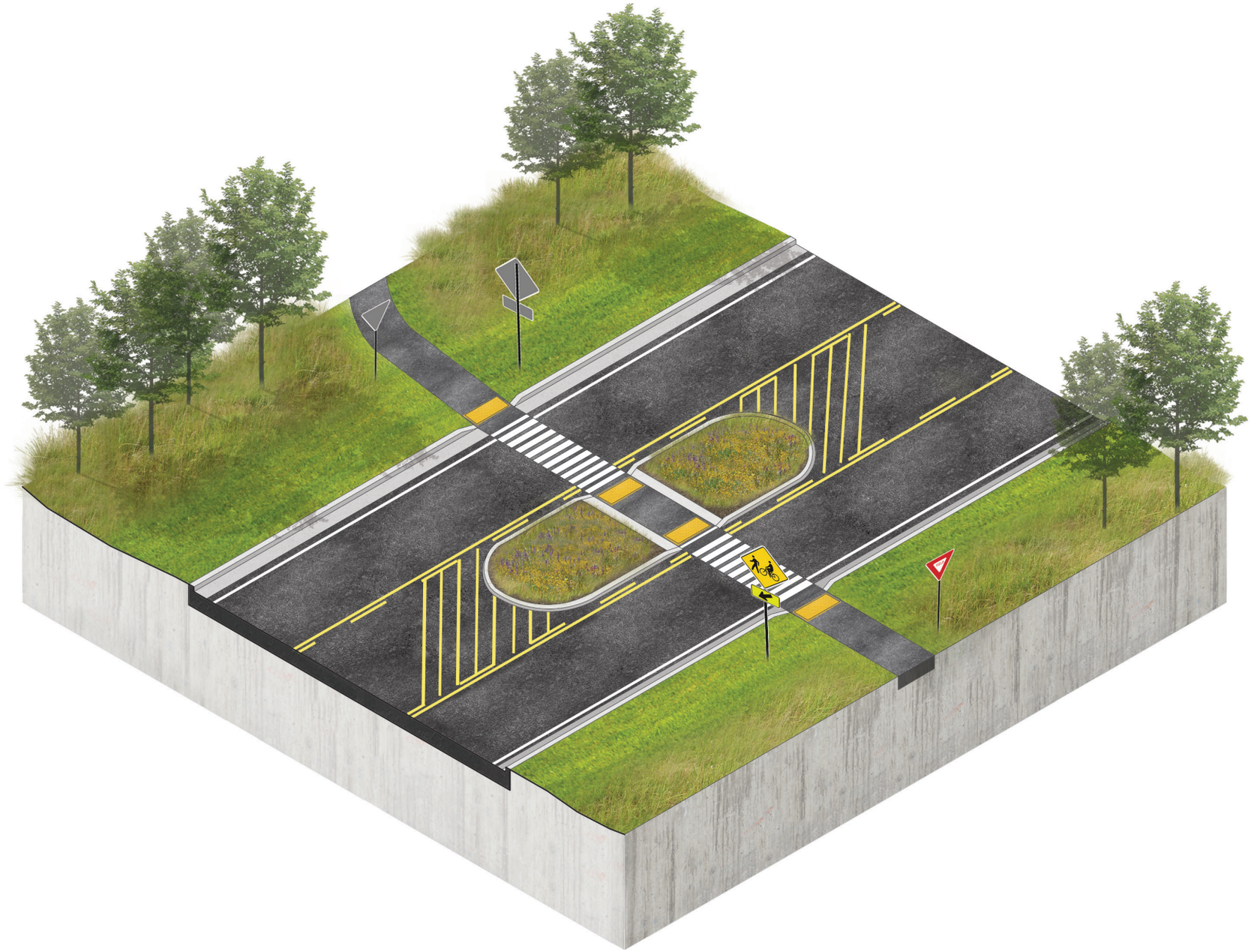
C SIGNAGE
C2 AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY
C4 HISTORICAL AND EDUCATIONAL

D BUFFERS
D3 BARRIERS/SAFETY/CURB + BOLLARDS
BORDERS/SPECIMEN PLANTINGS
D4 COORDINATED MATERIALS

E LIGHTING
E2 URBAN TRAIL

F AMENITIES
F2 ENRICHMENT/ART/COMMERCIAL
F3 BIKE PARKING/BIKE REPAIR
F4 WELFARE + SANITATION
F5 REST + SHELTER
F6 POCKET PARKS

CROSSING // MIDBLOCK



MIDBLOCK CROSSING

When trails need to cross roads midblock, several measures may be taken to ensure the safety of all trail users. The land around the crossing should be cleared or planted with low vegetation to ensure adequate sight lines between greenway users and motor vehicle traffic. The trail should cross the road at a right angle. Signage should include notification to the trail users of the approaching road and signs alerting drivers to the presence of a greenway crossing. Signs directed at greenway users may be post-mounted or stenciled on the trail, or both.

The addition of a refuge between the travel lanes should be considered if the road width is sufficient. This feature allows greenway users to cross the road in stages as well as providing a visual cue to drivers of the crossing location. The use of a curve in the trail to slow down cyclists before a crossing is recommended.

PEDESTRIAN REFUGE, KNOX COUNTY

A CROSSINGS
A2 AT GRADE/ROAD

B SURFACES
B2 MATERIALS/ACCESSIBLE/RECREATIONAL
B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
C2 AT DRIVER/AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY

D BUFFERS
D4 BORDERS/SPECIMEN PLANTINGS/ COORDINATED MATERIALS

E LIGHTING
E2 ROADWAY CROSSING

F AMENITIES
F3 SAFETY/CALL STATION
F5 REST + SHELTER/SHADE

RAILSIDE TRAILS

INTRODUCTION TO RAIL-TRAILS TRAILS

Greenways built along rail corridors are becoming increasingly common. In the U.S. there are 1,800 rail-trails totaling more than 21,000 miles. As of 2013, Tennessee is home to 23 completed rail-trails adding up to 89 miles of trail. There are eight additional rail-trails projects active in the state that will add 65 more miles of trails when completed.

Rail corridors are typically located along level or gently sloping stretches of land, making them ideal for the many modes of active transportation greenways support. Rail corridors often traverse urban, suburban, and rural landscapes and link communities, making them excellent recreational and transportation corridors. Additionally, rail corridors often contain infrastructure, such as tunnels and bridges, which may be used by trail builders.

A primary benefit of rail corridors is the contiguous property ownership provided by the rail right-of-way (ROW). Greenway corridors may be incorporated into the ROW of active rail lines, take the place of former rail corridors, or temporarily utilize out-of-service rail corridors.

OPPORTUNITIES FOR RAILSIDE TRAILS

Rail corridors present several opportunities for greenway installation along active railroads (rails-with-trails), former railroads (rails-to-trails), and out-of-service railroads (railbanking).

RAILS-WITH-TRAILS

Rails-with-trails are greenway trails located parallel to an active rail line. The trail is often separated by fencing. Rails-with-trails may be located along high-speed rail lines or along slow-moving tourist rail lines. The trail may be within the railroad ROW, or in an easement along the rail line. A unique opportunity presented by rails-with-trails is connecting non-motorized transportation routes with public transportation, such as greenway trails that link to passenger train stations.

RAILS-TO-TRAILS

Rails-to-trails are a conversion of former rail corridors into greenway corridors. Many aspects of rail line infrastructure, such as bridges and road intersections, may be converted into greenway infrastructure by replacing rails and cross ties with appropriate trail surface materials.

RAILBANKING

When a rail line goes out-of-service, one option that may be considered is railbanking. Railbanking is a voluntary agreement between a railroad company and a trail agency that allows the out-of-service rail corridor to be managed as a trail until the railroad might need the corridor again for rail service.

The process of railbanking in Tennessee begins with a railroad company filing a notice of intent to abandon a section of railroad with the Surface Transportation Board (STB). The STB makes a public notification of that intent, and it is generally a 60-day notification period. (The Rails-to-Trails Conservancy has a notification system in place to alert communities when rail companies intend to abandon rail lines.)

An interested agency – in Tennessee this is generally a local government – then files a notice of intent (NOI) to seek notice of interim trail use (NITU) with the STB. Along with the request for the NITU, a letter accepting the financial responsibility for the NITU must be submitted to the STB at the same time.

If the STB makes the determination to accept the NITU, the corridor is railbanked. This NITU is good for 180 days, and during this time the agency can contact the railroad company to begin the negotiation for purchase. The NITU must be renewed every 180 days until the corridor is purchased.

If the STB determines a corridor is eligible to be abandoned, adjacent landowners will often start to file legal actions to claim the land that was part of the railroad ROW. This can make assembling land for a rail-trail difficult.

COMMON CHALLENGES

Safety concerns are frequently cited as a deterrent to trails along an active rail line. Research in a 2013 report by the Rails-to-Trails Conservancy (RTC) cited "one record of a fatality involving a rail-with-trail user and a train, and just two reports of injury, in the 20-year period of our study of the subject." RTC suggests the low number of crashes involving rail-with-trail users is attributed to carefully designed trails, signage, barriers, and rail crossings that reduce the incentive for people to trespass on rail lines.

BUILDING RAIL-TRAILS

Constructing a trail along an active rail line requires receiving the proper permissions from the rail company. This can be a challenging process. The RTC's website has resources and guidance on rail-with-trail projects. Once permission has been obtained, design professionals can oversee the process of creating safe trail passages along the rail line and at crossings.

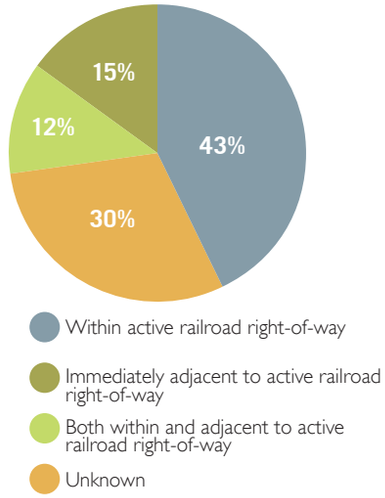
REFERENCES

Frequently asked questions. Accessed Oct. 29, 2013. www.railstotrails.org/ourWork/trailBasics/FAQs.html

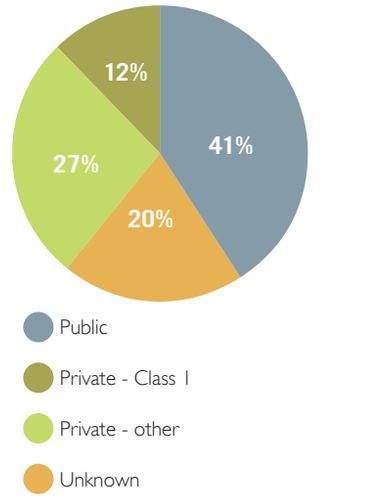
Rails-to-Trails Conservancy. 2013. America's Rails-with-Trails: A Resource for Planners, Agencies and Advocates on Trails Along Active Railroad Corridors.

Rail-Trail Statistics. Accessed Oct. 29, 2013. www.railstotrails.org/ourWork/trailBasics/trailStats.html#national

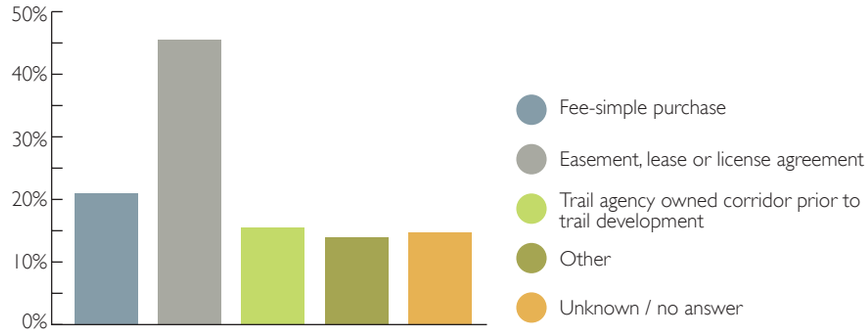
LOCATION OF TRAIL CORRIDOR RELATIVE TO ACTIVE RAILROAD RIGHT-OF-WAY



CORRIDOR OWNERSHIP OF RAILS-WITH-TRAILS WITHIN THE RAILROAD RIGHT-OF-WAY



TRAIL CORRIDOR ACQUISITION METHOD



A sample of results from the Rails-to-Trails Conservancy's (RTC) survey of rails-with-trail in the U.S.


BEFORE
ANDERSON COUNTY, TN

AFTER // RURAL RAIL TO TRAIL


BEFORE
LOUDON COUNTY, TN

AFTER // SMALL TOWN RAIL TO TRAIL

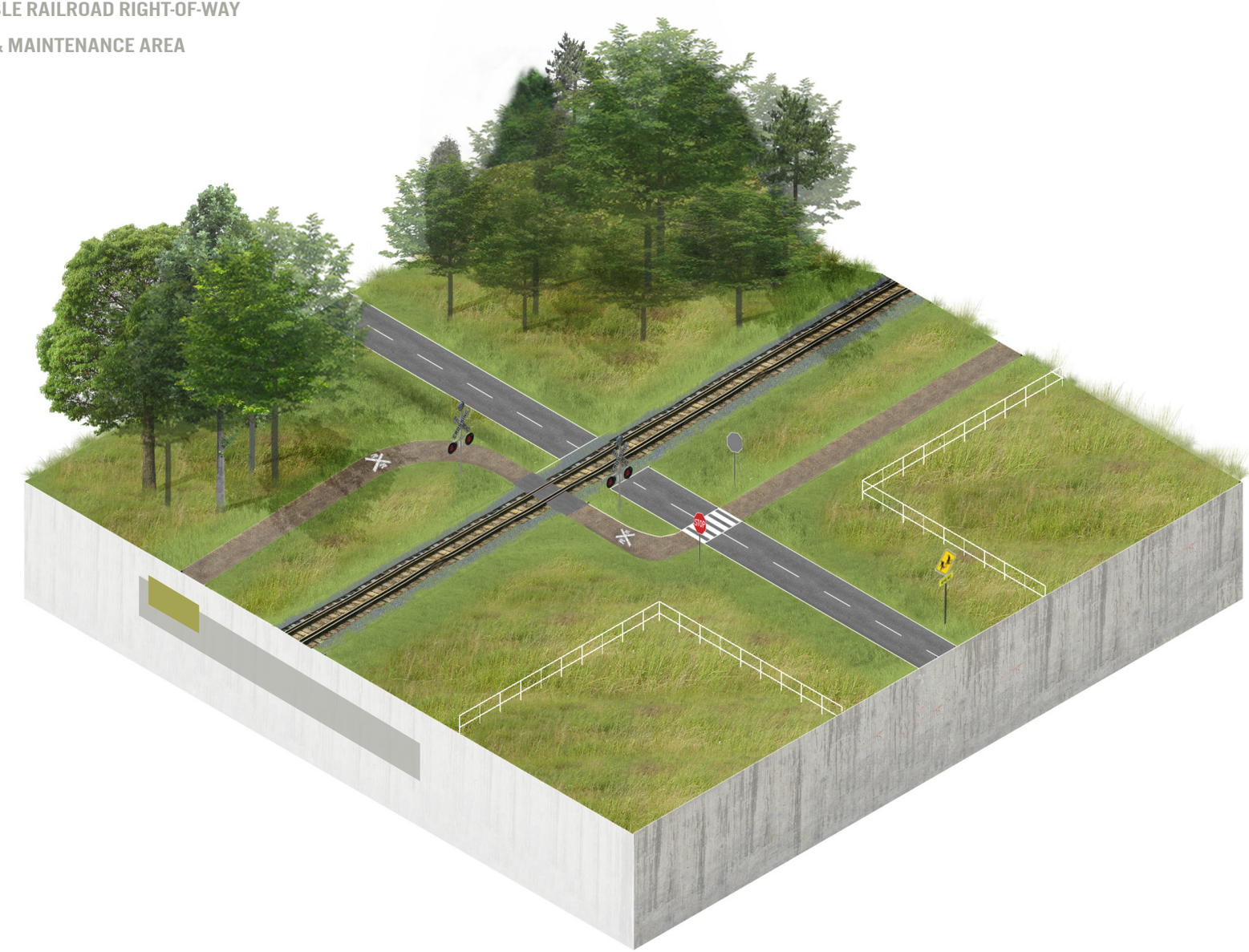
BEFORE
KNOX COUNTY, TN

AFTER // URBAN RAIL WITH TRAIL

RAILS WITH TRAILS // RURAL

VARIABLE RAILROAD RIGHT-OF-WAY

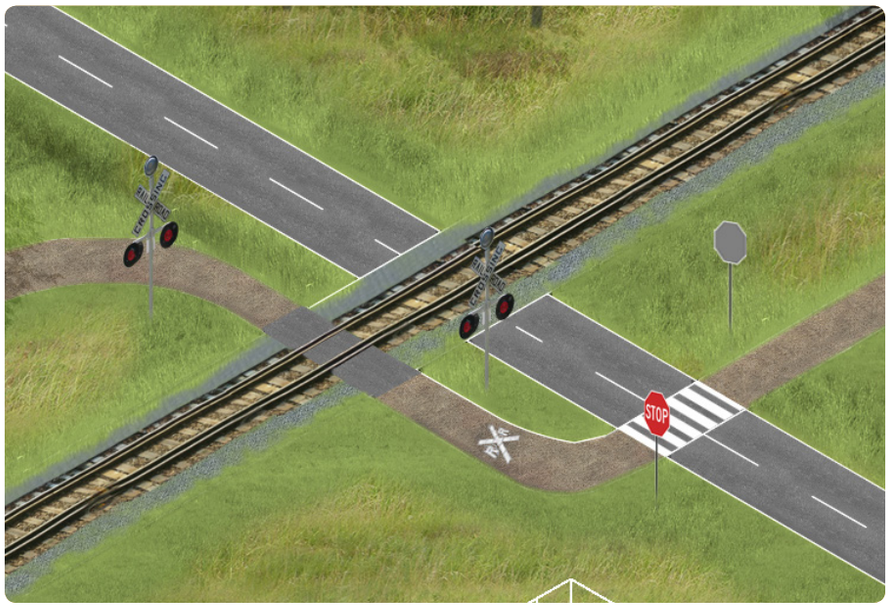
TRAIL & MAINTENANCE AREA



RURAL RAILS WITH TRAILS

Rail lines in rural settings provide long-distance, gently sloped corridors that are ideal for greenway trails. In many cases, the ROW along a rail line is sufficient for a trail, providing a contiguous stretch of land and existing infrastructure for crossing that can link communities to each other and to regional recreational resources.

Trails located along rail lines in rural areas should use safety precautions such as maximizing the buffer zone between the rail line and the trail and utilizing grade changes to provide separation between the trail and rail line. Trails should be planned to cross rail lines at existing crossings, such as at roads, where safety signage and signals are already present.



A CROSSINGS
A2 AT GRADE/ROAD/RAIL

B SURFACES
B2 MATERIALS/ACCESSIBLE/RECREATIONAL
B4 TRAIL SIDES/LEVEL

C SIGNAGE
C2 SAFETY SIGNAGE AT DRIVER/ AT GREENWAY USER
C3 WAYFINDING/ON GREENWAY

D BUFFERS
D3 BARRIERS/SAFETY

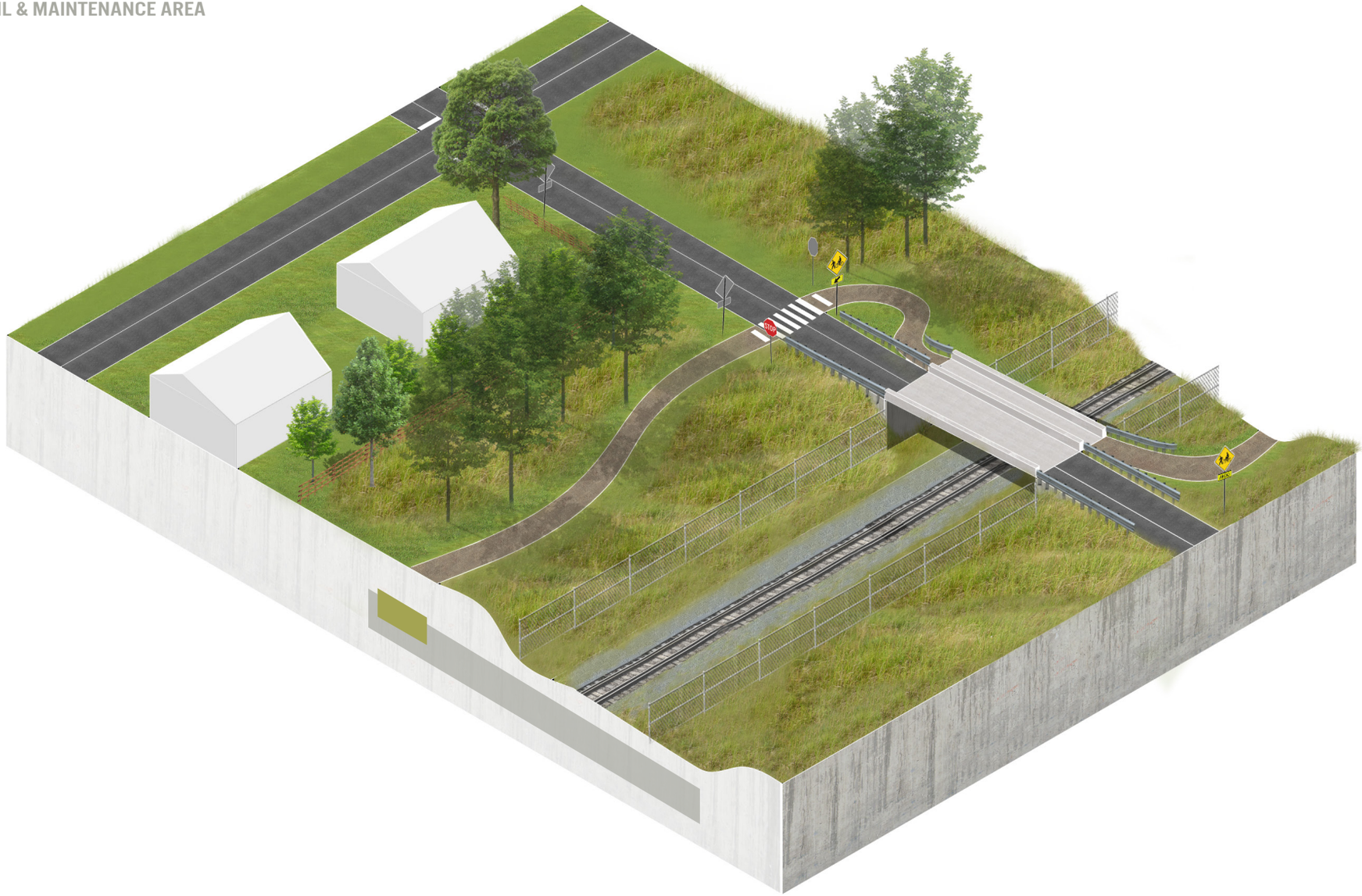
E LIGHTING
E2 ROADWAY CROSSING

F AMENITIES
F1 ENRICHMENT/SCENIC
F2 SAFETY/EMERGENCY STATION
F4 REST + SHELTER/SHADE

RAILS WITH TRAILS // SUBURBAN RESIDENTIAL

VARIABLE RAILROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA



SUBURBAN RESIDENTIAL RAILS WITH TRAILS

Rail lines in suburban residential areas provide contiguous stretches of land that may be utilized by the adjacent community for recreation and commuting. Rail lines in suburban residential areas are typically surrounded by ample land to provide sight and sound buffers between the rail line and neighborhoods. Greenway trails may be planned along an easement or within the rail line ROW.

In residential areas, fences or other safety barriers should be used to create separation between the trail and the rail line. The greenway corridor may include buffering, such as dense planting, between the trail and rail line and the trail and private property to increase safety and maximize privacy. When a trail must cross a suburban rail line, utilize existing crossings for additional safety.

A CROSSINGS
- A2 AT GRADE/ROADS
- A3 OVER/MULTI-USE BRIDGE

B SURFACES
- B2 MATERIALS/ACCESSIBLE
- B3 INCLINES/ACCESSIBLE RAMPS/ HANDRAILS

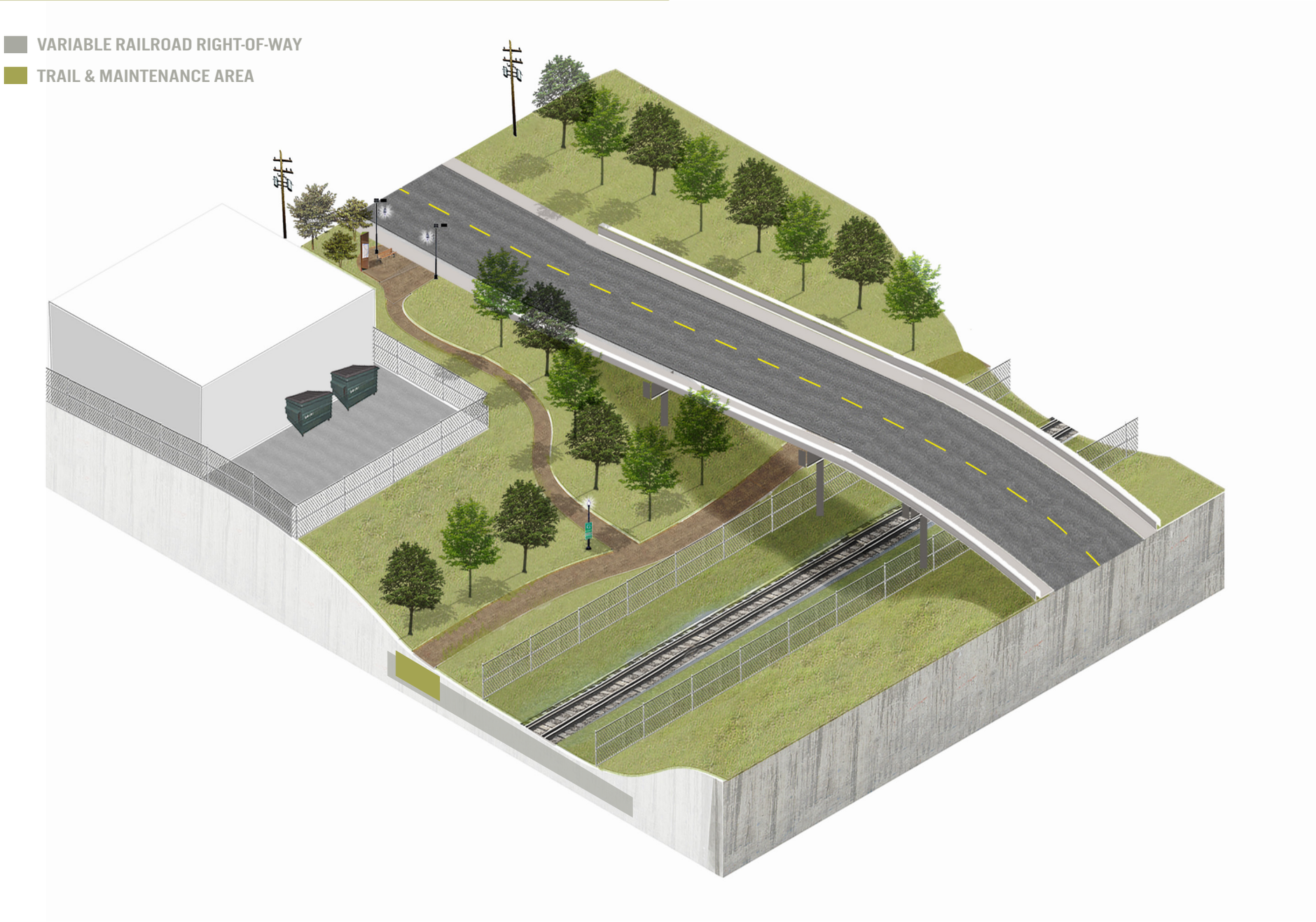
C SIGNAGE
- C2 SAFETY SIGNAGE AT DRIVER/ AT GREENWAY USER

D BUFFERS
- D3 BARRIERS/SAFETY/ PRIVACY + TRESPASS
- D4 BORDERS/PRIVACY

E LIGHTING
- E2 ROADWAY CROSSING

F AMENITIES
- F4 REST + SHELTER/SHADE

RAILS WITH TRAILS // URBAN



URBAN RAILS WITH TRAILS

Rail lines in urban areas provide contiguous stretches of land that may be utilized by the adjacent community for recreation and commuting. Rail lines in urban areas typically pass through industrial areas and under roadways, conditions which may narrow the rail line corridor. Greenway trails may be placed within the rail line ROW as long as sufficient safety measures are taken.

Fences and safety barriers should be used to create separation between the trail and the rail line. Greenway trails may take advantage of rail-crossing infrastructure, such as a viaduct for passing under a multi-lane road. Lighting and decorative treatments such as murals should be considered to improve safety and the greenway user's experience.

DECORATIVE MURAL IN UNDERPASS, KNOX COUNTY

A CROSSINGS
A1 UNDER/UNDERPASSES

B SURFACES
B2 MATERIALS/ACCESSIBLE

C SIGNAGE
C2 SAFETY SIGNAGE AT DRIVER/ AT GREENWAY USER

D BUFFERS
D3 BARRIERS/SAFETY/ PRIVACY + TRESPASS

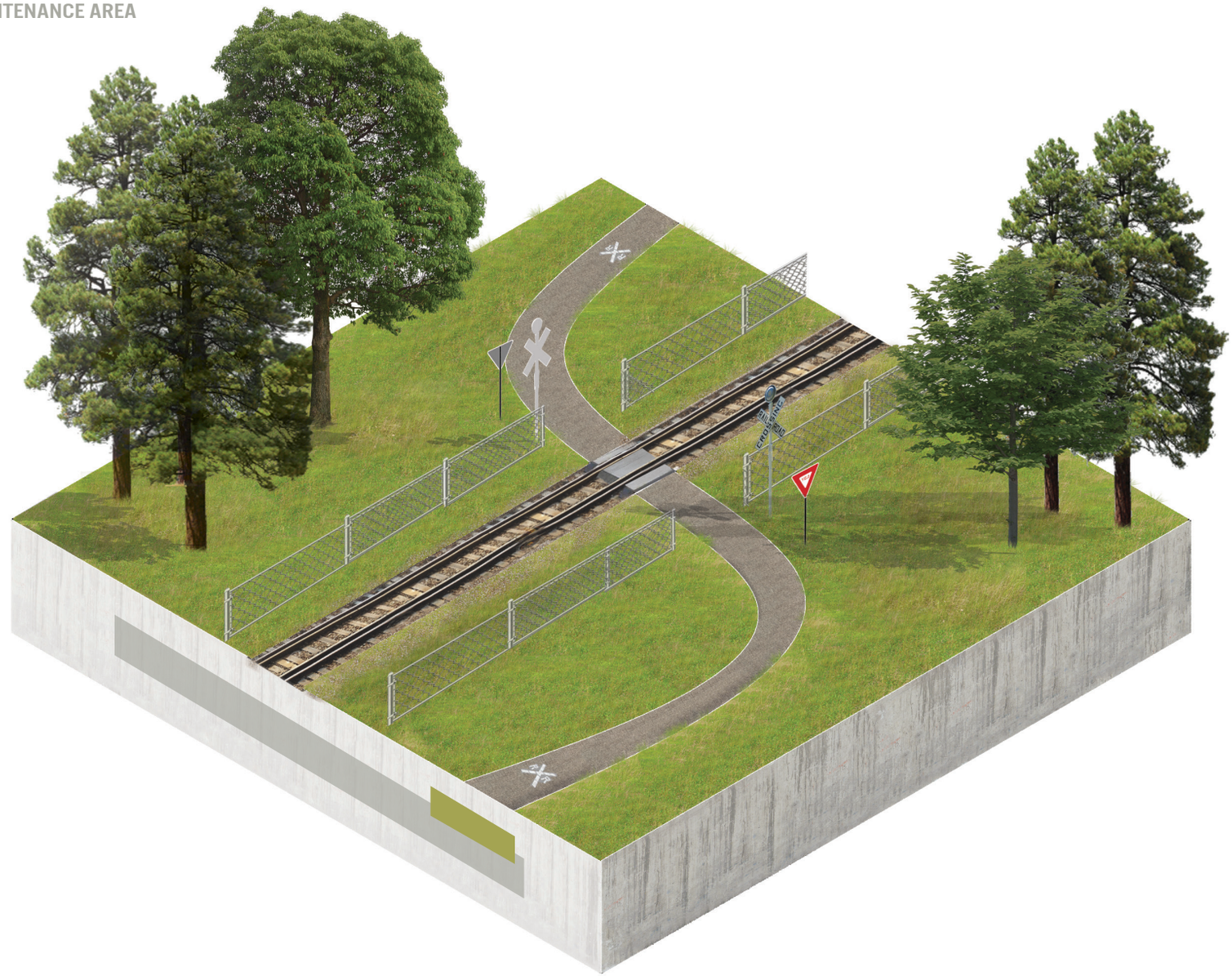
E LIGHTING
E2 TRAILHEAD/URBAN TRAIL

F AMENITIES
F1 ENRICHMENT /MURALS + ART/ COMMERCE
F4 REST + SHELTER/SHADE

RAILS WITH TRAILS // CROSSING

VARIABLE RAILROAD RIGHT-OF-WAY

TRAIL & MAINTENANCE AREA



CROSSING RAILS WITH TRAILS

When trails cross active rail lines at grade, several measures may be taken to ensure safety. The land around crossings should be cleared or planted with low vegetation to ensure adequate sight lines for the greenway user. The trail should be designed so that it crosses the rail line at a right angle; this will help prevent bicycle tires from becoming stuck in the rail lines. The trail may also curve sharply just before the crossing to force the trail user to slow down.

Fencing should be installed close to either side of the trail to discourage trail users from straying off the trail. Signage can be stenciled on the trail surface, and vertical signage, including advanced crossing signs and crossbucks, should be placed in the trail shoulder.

TRAIL CROSSING RAIL, BLOUNT COUNTY

A CROSSINGS
A2 AT GRADE/RAIL

B SURFACES
B2 TYPICAL MATERIALS/ ACCESSIBLE TRAIL

C SIGNAGE
C2 SAFETY SIGNAGE/ AT GREENWAY USER

D BUFFERS
D2 BUFFERS/SAFETY BUFFERS
D3 BARRIERS/SAFETY /PRIVACY+TRESPASS

E LIGHTING
E2 ROADWAY CROSSING

F AMENITIES
F2 SAFETY/EMERGENCY STATIONS

WATERSIDE TRAILS

INTRODUCTION

Waterside trails are some of the most traveled routes in greenway systems. People are naturally drawn to the trees, landscapes, and wildlife that water attracts and supports. We all remember childhood walks along a stream bank, watching ducks, frogs, polliwogs, salamanders, and fish in creeks, ponds, lakes, and wetlands. Fishing, wading, swimming, tubing, canoeing or even kayaks and stand-up paddleboards become possible – if water is clean enough.

BENEFITS

Waterside trail segments offer multiple benefits to nearby residents, homes and businesses. Among the most apparent benefits of waterside corridors are the many scenic and recreational opportunities for residents to get close to nature, including walking trails, quiet waterside overlooks or access points, fishing sites, and bird and wildlife areas that take advantage of the diverse habitats, nesting sites, food and water available to wildlife near waterways. Well-located launch sites for tubes, canoes, kayaks, and stand-up paddleboards both encourage water-related recreation and support businesses that offer guided tours and rent equipment.

However there are other benefits that communities may not be aware of:

- Floodplain areas included in waterside corridors store surplus stormwater, helping to protect downstream homes and businesses from flooding
- Established floodplains, forests and grasslands help filter sediments, nutrients, and toxins out of stormwater draining toward a waterway, help hold soils in place, reduce soil erosion, and improve the safety and quality of water in waterways
- Stormwater held in natural floodplains recharges groundwater, keeping water tables within reach of local wells, crops and plants

COMMON CHALLENGES

Waterside trail segments also have some distinct challenges associated with fragility of waterside environments, water quality in both the waterway and community, and location of the trail routes and surfaces in the corridor.

FLOODING IMPACTS

One particular challenge to trail location, construction, and maintenance is the impact of flooding. Trail surfaces located in or too close to a floodway are prone to washouts and need frequent maintenance. It is a good practice to locate primary trails and paved trail surfaces outside of the floodway, or even outside the 100-year floodplain in areas that are flood-prone. Small loops or spur trails can extend from the primary trail to create direct access to waterways. Minimizing the number of waterside access points and locations where a route crosses the waterway also results in significant construction and maintenance savings. Examples in this section and in Visual Indexes on Crossings (A), Trail Surfaces (B), Buffers, Barriers, Borders (D) offer more information relevant to trail location, crossings and surfaces in waterside areas.

WATER QUALITY

Water quality is a very significant condition to consider with waterside greenway corridors. Waterways with poor water quality support fewer activities and negatively impact the quality of local community water supply drawn from waterways or groundwater sources.

MEASUREMENTS OF IMPACT LOADS

Measurements of impact loads identify amounts of compounds that reduce water quality. The state of Tennessee uses a measurement system called Total Maximum Daily Loads (TMDL) to decide if a waterway needs to be listed as "impaired" or as a "non-contact" stream. It is a good idea to check Tennessee's 303(d) list to see if a local stream is listed impaired or non-contact before making water recreation plans. Typical impacts measured include erosion sediments, pathogens such as E. coli, nutrients such as fertilizers, and toxins (which includes a wide range of metals, pes-

ticides, automotive fuels and oils, and industrial compounds). Other measurements such as dissolved oxygen, temperature, and pH (acid or alkaline) are particularly important in waterways where communities want to encourage fish and wetland species, including frogs, salamanders, mussels, and crayfish.

EROSION AND SEDIMENTS

Erosion and sediment impacts are relatively easy to reduce through use of Best Practices during planning, construction, and maintenance of greenway trails, maintenance areas and corridors.

Taking certain steps during planning and construction of trails will help protect water quality:

- Avoid cut and fill that removes vegetation and rearranges soil on site whenever possible
- Pay particular attention to identify and stabilize steep or erosion-prone slopes, unstable soil areas, and undercut stream bank areas near waterways and wetlands
- Native vegetation with mixed root depths is a preferred choice for stabilization wherever it will work
- Minimize the number of bridge crossings, spur trail, or boat ramp accesses that create openings in the waterside buffer

Next to the waterway, maintain continuous vegetation buffers between the trail and water to stabilize creek banks and prevent erosion. If waterside areas are already woodlands or grasslands, the best practice is to disturb these areas as little as possible in selecting routes and building the trail, particularly next to the water.

In the floodplain, encourage property owners to avoid these things:

- Removing established grasses or vegetation that are stabilizing soils
- Plowing, clear-cut or extensive thinning of grasslands, native waterside trees, shrubs and grasses
- Constructing structures that may wash away in a flood
- Overgrazing pastures near waterways. Hayfields and passive recreation are examples of traditional floodplain uses in this area that stabilize and prevent erosion of bottomland soils

In trailshed areas, property owners should be encouraged to take these steps:

- Minimize flattening of slopes and filling of swales during planning and constructing projects. Water has a strong tendency to follow its natural downhill path; disturb that natural path and erosion will create both maintenance headaches and sediment-filled water
- Minimize areas of clear cut or extensive thinning of forest or vegetation
- Maintain intermittent creeks, gullies, swales and ditches that drain to the waterway in native vegetation and songbird habitat
- Where creeks or intermittent waterways bordering on neighborhood or commercial areas connect to a greenway corridor, consider acquiring passage rights for waterside pedestrian connector trails and include plantings that filter and improve water quality

NUTRIENTS, TOXINS AND PATHOGENS

Nutrients are chemicals such as fertilizers, nitrogen and phosphorus that encourage growth of crops, gardens, lawns and other plants. **Toxins** are chemicals that negatively impact the health of people and other living things. **Pathogens** are microorganisms such as E. coli that cause sickness in people and animals. Pathogens that enter a local waterway may also be transferred between species.

Nutrients, toxins, and pathogens usually enter waterways by washing off of the surfaces of roads, lawns and parking lots when it rains. Planners refer to this as non-point source pollution because the problems result from small quantities coming from many different places. These natural and man-made materials may not cause problems in the small quantities usually encountered at a single home, farm, or business. However, when many small quantities collect in a waterway, concentrations may rise to levels that start to cause problems with community health and drinking water or cause the waterway to be listed as impaired or non-contact. This is why the negative impacts of nutrients, toxins and pathogens are often greater in areas where homes and businesses are closer together.

In trailshed areas, floodplains, and floodways, encourage property owners, communities, and lawn care companies to use practices that reduce the use of fertilizers and pesticides:

- Use regional garden and lawn plants that don't require fertilizers
- Improve soils so less fertilizer is needed
- Practice timed application of fertilizers, pesticides and other landscape supplements

FINDING SPACE TO BUILD WATERSIDE TRAILS AND EFFECTIVE CORRIDOR WIDTH

Waterways meander back and forth across their floodplain, cut through ridges to create gaps, overflow their banks and flood. Shorelines of lakes, ponds, and wetlands change too, depending on the time of year and amount of rain. This poses a challenge for locating waterside trail segments. The term **effective width** describes the width a greenway corridor needs to be in each segment. Ideally, the effective width for each waterside corridor segment includes the area covered by a waterway's natural meander or high and low water shoreline change in wetlands and waterbodies, plus enough space for the trail, a waterside water quality buffer, and privacy buffers or screening for any adjacent property owners. Thus, effective width in a waterside corridor can vary greatly, becoming quite narrow in a rocky valley gap to much broader where two waterways join together in a valley.

Finding space for a corridor and trails is usually easy in valleys or floodplains. However, where a waterway cuts a water gap through ridges, there are often steep rocky side slopes and the gap may contain the stream plus road and railway rights-of-way. Sometimes, avoiding the gap entirely and instead working to find a route for the trail up and over the ridge in another location works. If the only possible location is in the tight spot, locating the trail higher or lower than the road or rails, or the use of bridges and boardwalks, can sometimes make space where there is seemingly none. Care should be taken to keep trail surfaces, ridges, and boardwalks out of floodways in tight corridors.

OPPORTUNITIES

RECREATIONAL OPEN SPACE

Waterside trails can be routed from a corridor through existing or planned waterside recreation areas that offer opportunities for swimming beaches, splash fountains, organized sports, boat launches or marina access. Greenway planners should identify opportunities to integrate parking, trailheads and a variety of trails into a recreation area. (Examples: Concord Park, Norris State Park.)

SHARED RIGHT-OF-WAY CORRIDORS

East Tennessee has many waterside areas that are already in public ownership or adjacent to a road or rail right-of-way. In other areas it may be possible to obtain easements for a greenway corridor along water. Watersides that include road or rail rights-of-way are fairly typical conditions because there are many places in our landscape where road, rail, and streams are all passing through a water gap or a narrow area of the valley floor. In these areas, it takes careful design of vegetation and trails to make sure slopes, soils, and stream banks remain stable and don't erode – and bridges, roadbeds and trail beds don't encroach on stream's floodway or floodplain areas where high water can cause washouts, erosion, and maintenance problems.

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BEFORE
UNION COUNTY, TN


AFTER // RURAL WATERSIDE


BEFORE
BLOUNT COUNTY, TN

AFTER // SUBURBAN WATERSIDE

BEFORE
KNOX COUNTY, TN

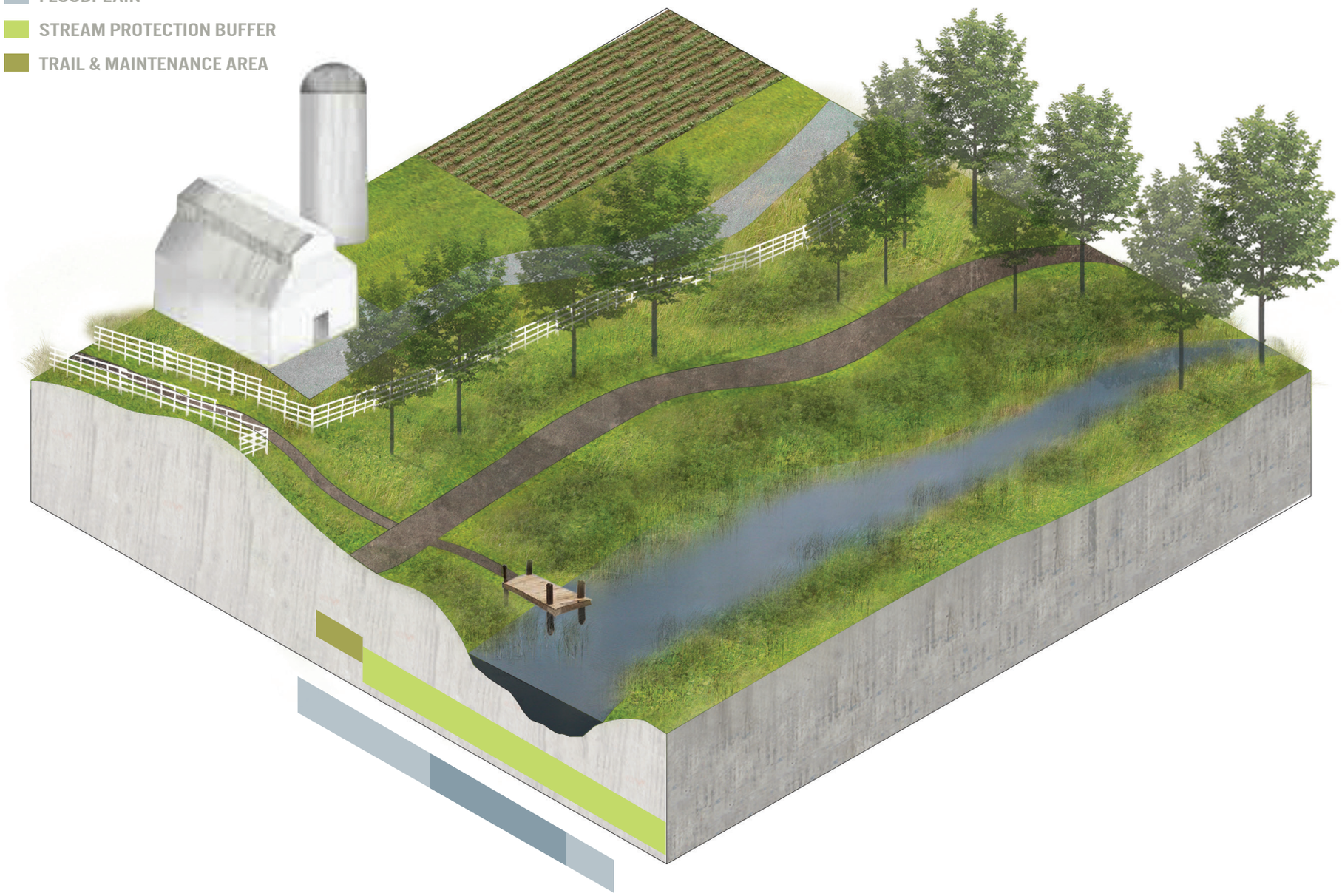
AFTER // SUBURBAN COMMERCIAL WATERSIDE


BEFORE
KNOX COUNTY, TN

AFTER // URBAN WATERSIDE

WATERSIDE // RURAL

FLOODWAY
FLOODPLAIN
STREAM PROTECTION BUFFER
TRAIL & MAINTENANCE AREA



WATERSIDE // RURAL

Many rural areas of East Tennessee have creeks that provide opportunities to create greenway trails for walking, running, and biking as well as for passive recreation, such as bird watching and wildflower walks. Between the trail and the waterway, maintain continuous vegetation buffers to stabilize creek banks and prevent erosion. If waterside areas are already woodlands or grasslands, the best practice is to disturb these areas as little as possible in selecting routes and building the trail, particularly next to the water.

Property owners near waterside trails should also be encouraged to take these steps:

- Maintaining and improving existing naturalized areas or creating water quality landscaping in locations where borders also function as landscape filters to remove chemical run-off from fields, drives, parking, patios and lawns
- Reducing clear cutting or extensive thinning of wooded areas along waterways
- Maintaining and improving meadow areas where possible, instead of replacing low-maintenance meadows with high-maintenance and less durable lawn grass
- Maintaining or replanting intermittent creeks, gullies, swales and ditches that drain to the waterway in native vegetation that both filters run-off and encourages songbirds and wildlife

A CROSSINGS

B SURFACES

B2 MATERIALS/ACCESSIBLE RECREATIONAL/BOARDWALK

B4 TRAIL SIDES/SLOPED/STEEP

C SIGNAGE

C3 WAYFINDING
C4 HISTORICAL/EDUCATIONAL

D BUFFERS

D2 WATER QUALITY BUFFER
D4 BORDERS/WAYFINDING/EDUCATIONAL

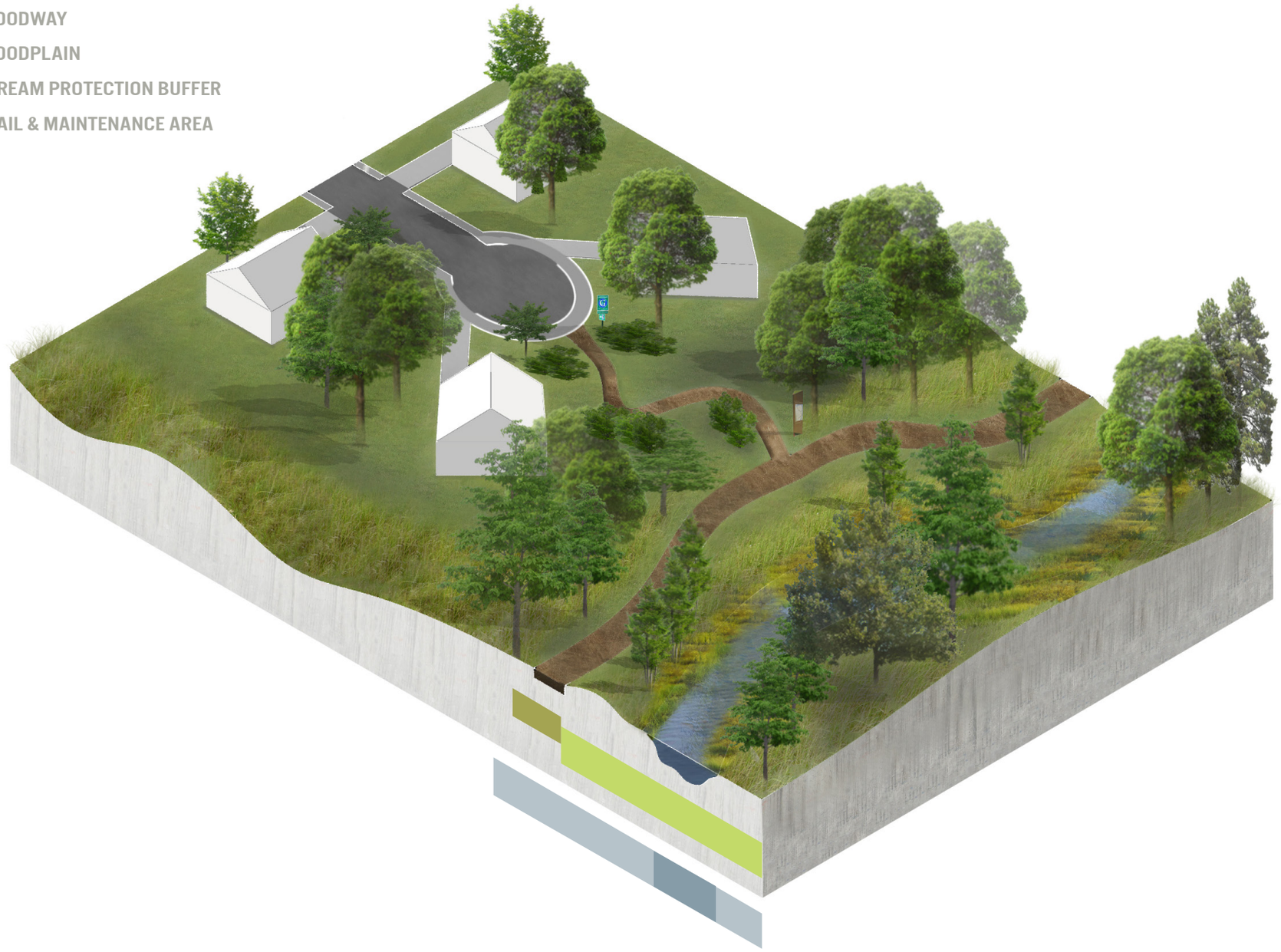
E LIGHTING

F AMENITIES

F2 ENRICHMENT/LEARNING
F3 PARKING/HORSE
F5 SHADE

WATERSIDE // SUBURBAN RESIDENTIAL

- FLOODWAY
- FLOODPLAIN
- STREAM PROTECTION BUFFER
- TRAIL & MAINTENANCE AREA



WATERSIDE // SUBURBAN RESIDENTIAL

Many waterside trails in suburban and urban areas of East Tennessee offer opportunities for connecting neighborhoods to each other and to nearby schools, parks and commercial areas. If a neighborhood has a creek along its border that connects to a greenway corridor, it may be possible to acquire passage rights for a connector trail to bring residents into the greenway corridor. In trailshed areas and floodplains, encourage property owners and lawn care companies to use practices that reduce the use of fertilizers and pesticides, such as the Nine Principles of a Tennessee Smart Yard.

NINE PRINCIPLES OF A TENNESSEE SMART YARD

1. Right Plant, Right Place: Landscaping
2. Amend Soils and Maintain Mulch: Composting
3. Manage Turfgrass
4. Manage Yard Pests
5. Water Efficiently
6. Use Fertilizer Appropriately
7. Reduce Stormwater Runoff and its Pollutants
8. Provide for Wildlife: Native Plants, Wildlife, Habitat
9. Protect Water's Edge

Resource: Tennessee Smart Yards:
ag.tennessee.edu/tnyards/Pages/A-Better-Yard-2.aspx

A CROSSINGS

B SURFACES
B2 MATERIALS/ACCESSIBLE/RECREATIONAL
B4 TRAIL SIDES/SLOPED/STEEP

C SIGNAGE
C3 WAYFINDING
C4 HISTORICAL/EDUCATIONAL

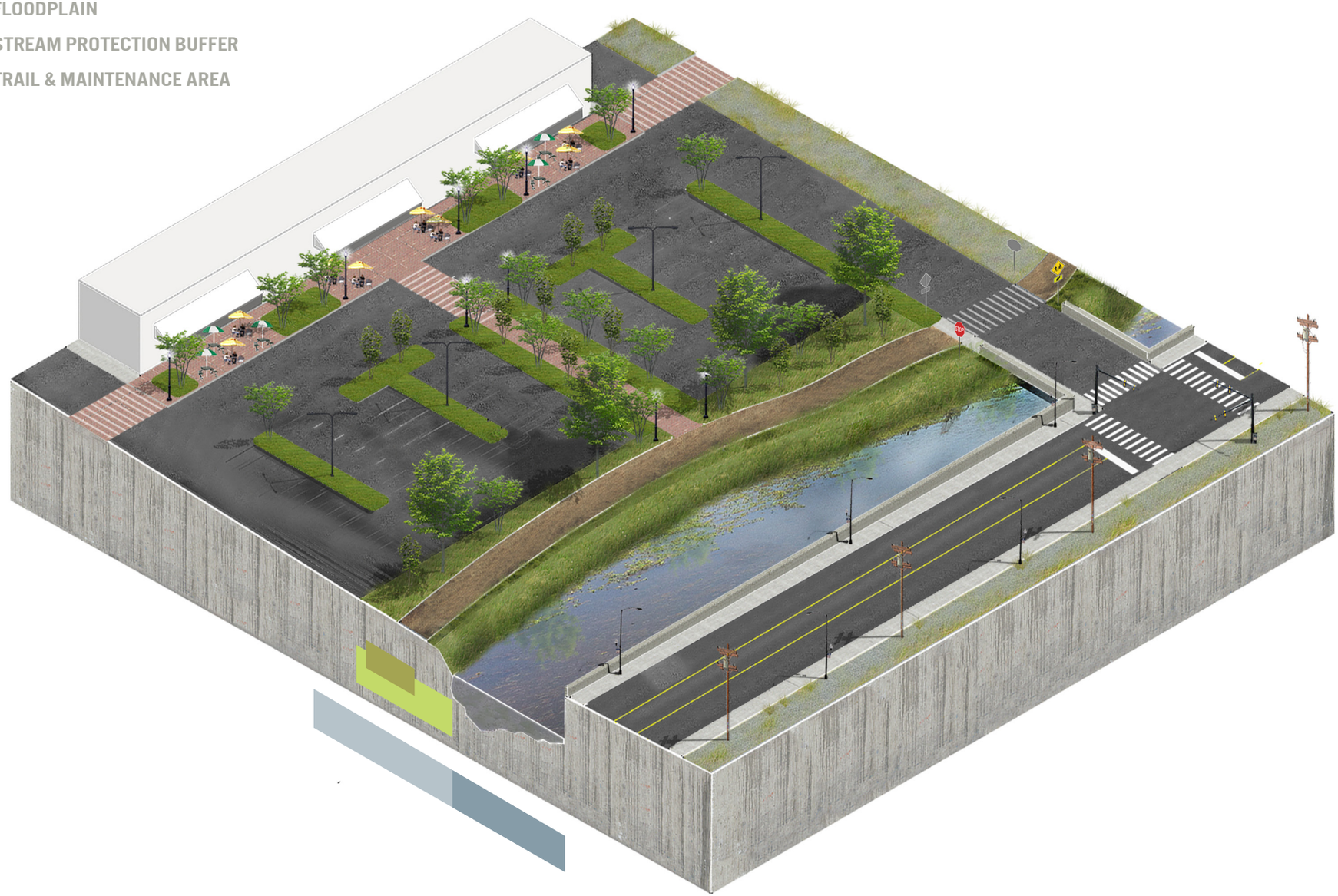
D BUFFERS
D2 WATER QUALITY BUFFER
D4 BORDERS/WAYFINDING/EDUCATIONAL

E LIGHTING
E2 MINOR TRAILHEAD
E2 TRAIL CROSSROADS

F AMENITIES
F2 ENRICHMENT/LEARNING
F3 PARKING/BIKE
F5 SEATING/SHADE

WATERSIDE // SUBURBAN COMMERCIAL

- FLOODWAY
- FLOODPLAIN
- STREAM PROTECTION BUFFER
- TRAIL & MAINTENANCE AREA



WATERSIDE // SUBURBAN COMMERCIAL

Many suburban and urban areas of East Tennessee have creeks that offer opportunities for greenway trails that connect commercial areas with nearby neighborhoods. Next to the waterway, maintain continuous vegetation buffers between the trail and water to stabilize creek banks and prevent erosion. Properly selected waterside vegetation can also filter sediment, nutrients, and toxins that collect in parking lot stormwater run-off from entering the waterway, which improves water quality. Spur trails can be added that run through the parking lot to connect the trail users directly to the businesses in the commercial strip.

A CROSSINGS
- A2 CROSSING/AT GRADE

B SURFACES
- B2 MATERIALS/ACCESSIBLE
- B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
- C2 AT DRIVERS/AT GREENWAY USER
- C3 WAYFINDING
- C4 HISTORICAL/EDUCATIONAL

D BUFFERS
- D2 WATER QUALITY BUFFER
- D4 BORDERS/WAYFINDING/EDUCATIONAL

E LIGHTING
- E2 MINOR TRAILHEAD
- E2 URBAN TRAIL

F AMENITIES
- F2 ENRICHMENT/COMMERCIAL
- F3 PARKING/BIKE/EMERGENCIES
- F4 HYDRATION/WASTE
- F5 SEATING/SHADE
- F6 POCKET PARKS

WATERSIDE // URBAN

- FLOODWAY
- FLOODPLAIN
- STREAM PROTECTION BUFFER
- TRAIL & MAINTENANCE AREA

WATERSIDE // URBAN

Many East Tennessee communities have some public waterfront. This space is an opportunity to create a central recreation area that reflects the character and values of the community. A green park with walking trails, a band shell or public pier, and lawn for fireworks may suit some communities. Other communities may want brick plazas, child-friendly play fountains and marinas. A town waterfront is a special place, and communities will want to work with design professionals or maybe even host a design competition to collect ideas on what might be possible.

VOLUNTEER LANDING, KNOXVILLE

A CROSSINGS
A2 CROSSING/AT GRADE

B SURFACES
B2 MATERIALS/ACCESSIBLE
B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE
C2 AT DRIVERS/AT GREENWAY USER
C3 WAYFINDING
C4 HISTORICAL/EDUCATIONAL

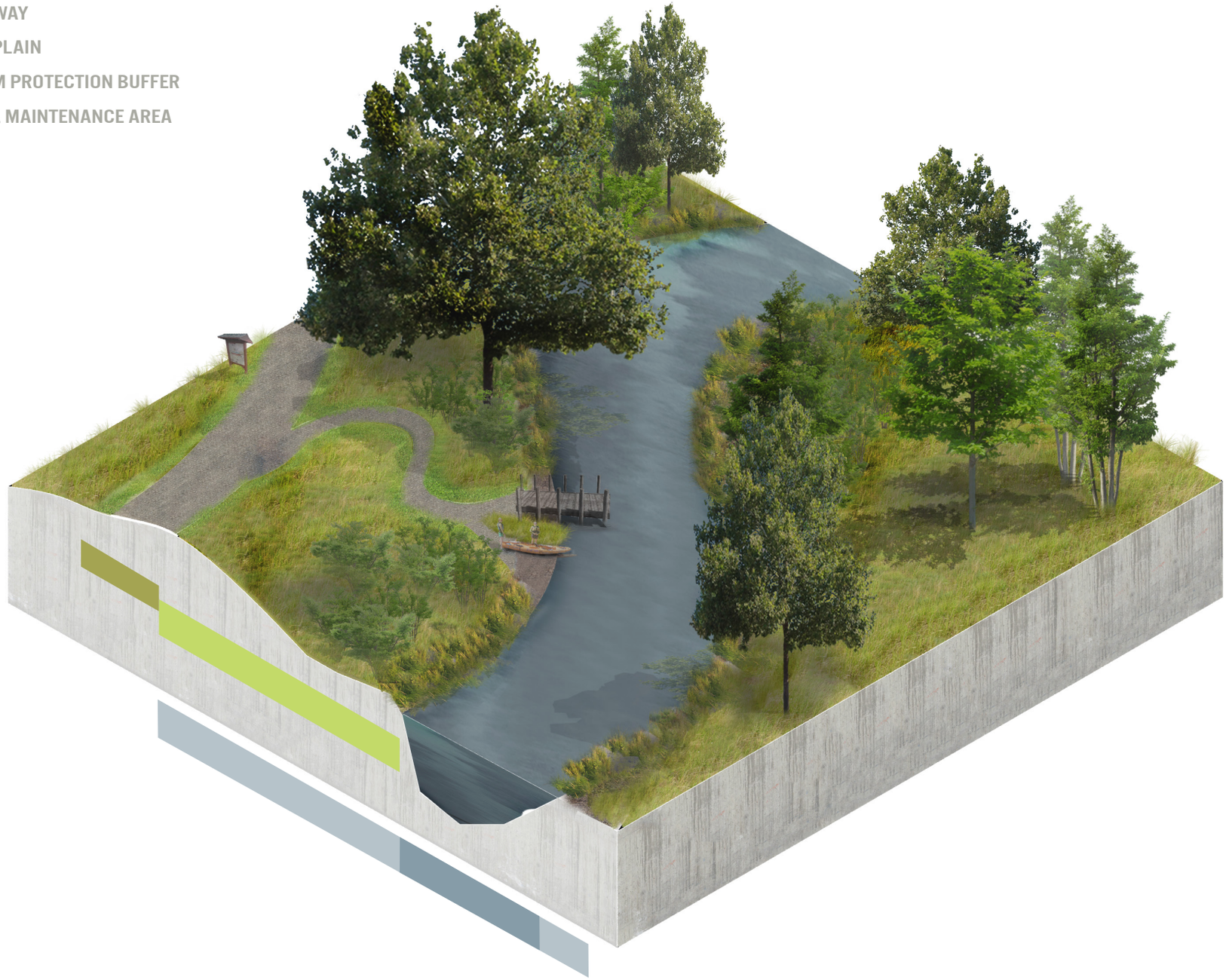
D BUFFERS
D2 WATER QUALITY BUFFER
D4 BORDERS/WAYFINDING/EDUCATIONAL

E LIGHTING
E2 URBAN TRAIL

F AMENITIES
F2 ENRICHMENT/COMMERCIAL
F3 PARKING/BIKE/EMERGENCIES
F4 HYDRATION/WASTE
F5 SEATING/SHADE
F6 POCKET PARKS

SPUR TRAIL TO BLUEWAY // RURAL

- FLOODWAY
- FLOODPLAIN
- STREAM PROTECTION BUFFER
- TRAIL & MAINTENANCE AREA



WATERSIDE // SPUR TRAIL TO BLUEWAY

Sometimes when arrangements for a corridor are being explored, waterside locations that are culturally significant or special locations for passive recreation, such as bird watching and wildflower walks, or active recreation such as swimming, become available. At times like these, a community can explore options for either expanding greenway corridor boundaries to include the site or finding an organization that may want to take ownership or stewardship of the resource.

One great way to enable active recreation is to create a spur trail to a blueway put-in for kayaks and other watercraft. In these areas, it takes careful design of vegetation and trails to make sure slopes, soils, and stream banks remain stable and don't erode. Take care to locate put-ins on the interior curve of the stream as opposed to on an outside curve where sediment is more likely to collect.

CLINCH RIVER, ANDERSON COUNTY

A CROSSINGS

B SURFACES

- B2 MATERIALS/ACCESSIBLE/ RECREATIONAL/BOARDWALK
- B4 TRAIL SIDES/LEVEL/SLOPED

C SIGNAGE

- C3 WAYFINDING
- C4 HISTORICAL/EDUCATIONAL

D BUFFERS

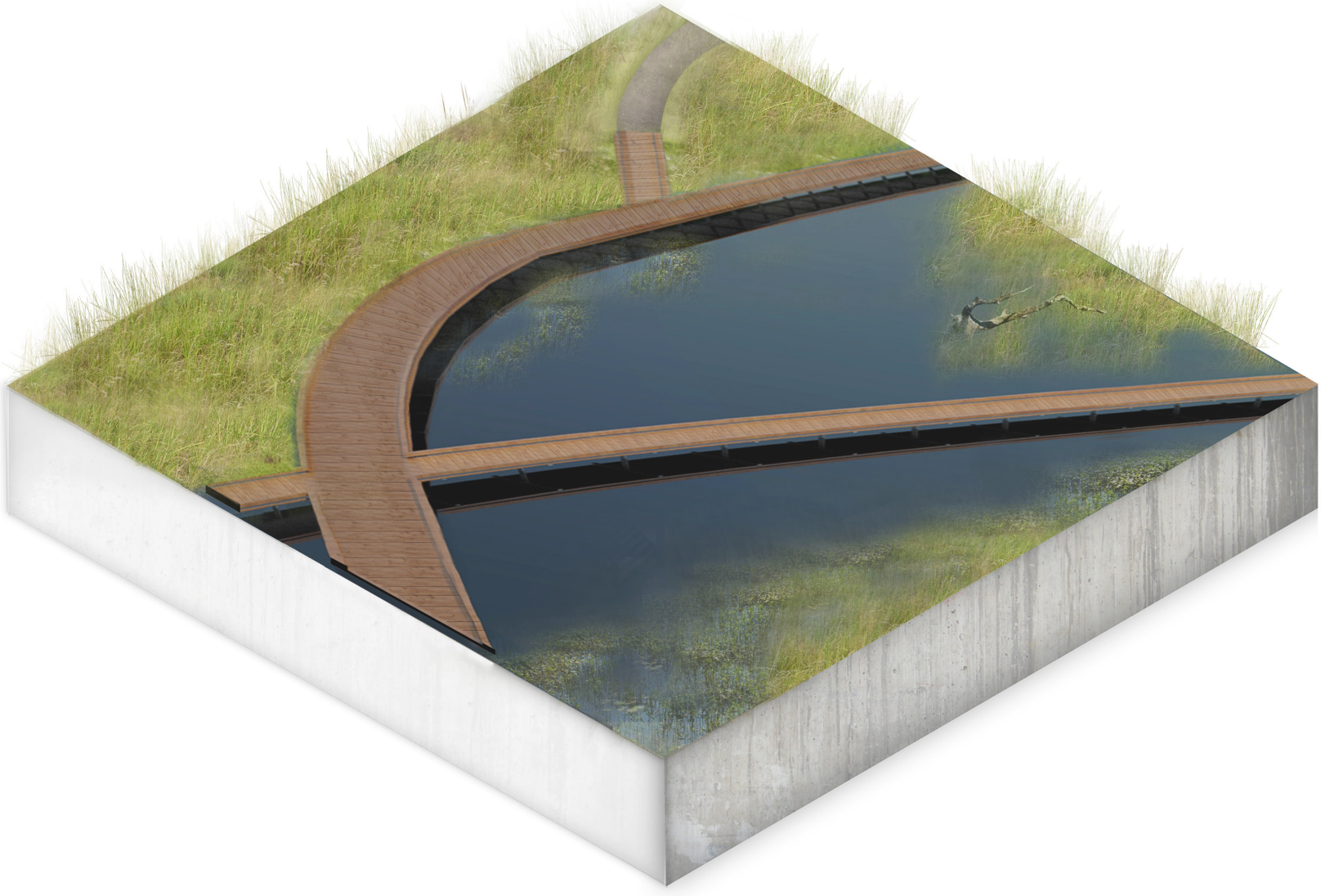
- D2 WATER QUALITY BUFFER
- D4 BORDERS/WAYFINDING/EDUCATIONAL

E LIGHTING

F AMENITIES

- F2 ENRICHMENT/LEARNING
- F3 PARKING/HORSE
- F5 SHADE

CROSSING // WETLANDS



WATERSIDE // WETLANDS CROSSING

This is probably what most people in East Tennessee think of when someone says "waterside trail." East Tennessee is blessed with an abundance of scenic creeksides, ponds, wetlands and springs, as well as larger navigable rivers and waterways. Our location on the Eastern flyway and variety of landscapes brings migratory birds and great opportunities to enjoy bird and wildlife areas. And, unlike some other areas of the United States, East Tennessee still has many opportunities to develop waterside recreational trails for both local residents and tourists. Waterside trail buffers also offer great opportunities to enhance habitat, nesting sites, and food sources for birds and other wildlife.

A CROSSINGS
A4 CROSSING OVER/BOARDWALKS

B SURFACES
B2 MATERIALS/ACCESSIBLE/ RECREATIONAL/BOARDWALK

C SIGNAGE
C3 WAYFINDING
C4 HISTORICAL/EDUCATIONAL

D BUFFERS
D2 WATER QUALITY BUFFER
D4 BORDERS/WAYFINDING/EDUCATIONAL

E LIGHTING

F AMENITIES
F2 ENRICHMENT/LEARNING

PART 3 // VISUAL INDEX

HOW TO USE PART III VISUAL INDEXES

The Visual Indexes provide the reader with the highest level of detail available in this guide. Each Visual Index is a different color and has information on a specific topic. The example landscape conditions illustrated in Part II have colored information bars that correspond with the Visual Indexes and point the reader to individual index items that are pertinent to that particular landscape. Visual Index B (Surface Materials), Index E (Lighting), and Index F (Amenities) also feature a Selection Matrix that allows a user to quickly find the products or amenities that should be considered at various types of trail locations (trailhead, trail segment, etc).

Readers who have already determined the basic route and configuration of their greenway corridor can jump directly to Part III for ideas and tips on specific items and issues. What types of bridges should be considered when the trail crosses a stream? How can educational signage be integrated into the trail? What are the initial costs and long-term maintenance costs associated with different trail surface materials? Information on questions like these is provided in the six Visual Indexes. Further tips on overall maintenance considerations as well as a suggested local plant palette are offered in the Appendices that follow the Visual Indexes.

Visual Index A provides strategies that can be employed when a greenway trail intersects with a barrier, another trail, or other forms of transportation infrastructure. Infrastructure used when a trail crosses a stream, rail line, or road is also illustrated. This index is divided into three parts: trails that cross under, trails that cross at-grade, and trails that cross over.

Visual Index B provides examples of surface materials for trails and maintenance areas that should be considered when designing a trail. Different surface materials are appropriate based on the slope, users, and location of a specific trail. General information about the cost, maintenance, and durability of each material is provided.

Visual Index C provides examples of signage commonly used within a greenway system. Safety signage, wayfinding signage, and markers for historical and educational purposes are all discussed.

Visual Index D explains the appropriate use and locations of safety barriers, privacy and trespass prevention barriers, buffers for water quality, air quality, and privacy, and decorative planted borders along a greenway trail. Diagrams are provided to explain locations and combinations of buffers and borders relative to different types of greenway trails.

Visual Index E outlines lighting options available for different locations within a greenway corridor. Diverse selections of trail locations are shown – from trailheads to standard trail segments. General information about each light fixture type is also provided.

Visual Index F gives an overview of the types of amenities available to consider along a greenway trail. This index is organized into five categories: economic opportunities along trails; amenities for safety, convenience, and parking; amenities for welfare and sanitation; opportunities for rest and shelter; and amenities for exercise and recreation.

A CROSSINGS
TRAILS CROSSING UNDER
CROSSING AT-GRADE
TRAILS CROSSING OVER

B SURFACES
MATERIALS MATRIX
TYPICAL TRAIL SURFACE MATERIALS
TYPICAL MATERIALS FOR INCLINES
TYPICAL MATERIALS FOR MAINTENANCE AREAS

C SIGNAGE
SIGNAGE & SIGNALS – TYPES
SAFETY SIGNAGE & SIGNALS
WAYFINDING SIGNAGE
HISTORICAL & EDUCATIONAL SIGNAGE

D BUFFERS
TRANSITION ZONES: BUFFERS, BARRIERS & BORDERS
BUFFERS
BARRIERS
BORDERS

E LIGHTING
LIGHTING MATRIX
EXAMPLE LIGHTING LOCATIONS
EXAMPLE LIGHT FIXTURES

F AMENITIES
AMENITIES MATRIX
ENRICHMENT PLACES & ECONOMIC OPPORTUNITIES
SAFETY, CONVENIENCE & PARKING
WELFARE & SANITATION
REST & SHELTER
EXERCISE & RECREATION

A1 CROSSINGS INFRASTRUCTURE TRAILS CROSSING UNDER

INTRODUCTION

When trails intersect other trails, transportation infrastructure, steep terrain, or environmentally sensitive areas, a variety of approaches may be taken.

Crossing under obstacles such as roads, rail lines, and natural barriers usually requires an underpass or tunnel. These structures can be made safer and more pleasant with proper lighting and public art.

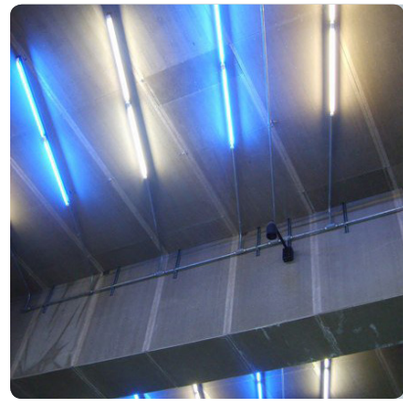
RESOURCES

- AASHTO Guide for the Development of Bicycle Facilities – refer to section on shared-use paths
- CPTED – refer to this PDF for an understanding of how design can aid in crime prevention: www.humanics-es.com/cpted.pdf
- FHWA – report "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Final Report and Recommended Guidelines," FHWA-HRT-04-100
- FHWA – summary guidance on the Rectangular Rapid Flash Beacon, FHWA-SA-09-009
- Rails to Trails Conservancy – refer to this for trails crossing active rail lines: www.railstotrails.org/ourwork/trailbuilding/toolbox/information-summaries/crossings.html

UNDERPASSES

Mural


Stream & Trail


Creative Lighting

TUNNELS


Partial Separation


Lights & Art


Arch

A2 CROSSING AT-GRADE

TRAIL CROSSING TRAIL

Material Change

Stenciled Signage

Low-level Planting

TRAIL CROSSING ROAD & RAIL

Advanced Crossing Signs

Crossing Location Signs

Pedestrian Refuge

Zig Zag Gate

Crosswalk Signage

Crossbucks & Stencil

CROSSING AT-GRADE

Trails intersecting other trails, roads or rail lines should include safety measures to warn, slow, or stop crossing traffic.

TRAFFIC CONTROL FOR CROSSINGS

STREETS AT TRAIL CROSSINGS

A standard treatment is a high-visibility marked crosswalk and appropriate signage (see Advanced Crossing Signs and Crossing Location Signs on this page). On local streets, consider the addition of traffic calming measures, such as rumble strips, speed humps, speed tables, curb extensions, etc. Where a street speed limit is 40 MPH or higher, or where the crossing is wider than two lanes, consider additional treatments. Additional improvements for higher speed or wider streets can include medians, higher visibility signs such as the Rectangular Rapid Flashing Beacon, HAWK beacons, and signals (where warranted).

TRAILS CROSSING TRAILS

Material changes, stenciled signage, and low level-plantings can be used to enhance visibility where trails intersect trails.

TRAILS CROSSING RAILS

Where trails cross active rail lines, use advance warning signs, crossbucks, and fencing for safety.

A3 TRAILS CROSSING OVER

CROSSING OVER

When trails encounter an obstacle that is not feasible to cross at or below grade, infrastructure for crossing over the obstacle may be used. A variety of trail bridges and boardwalks are available for crossing obstacles such as high-speed traffic, waterbodies, or sensitive environmental areas.

RESOURCES

- AASHTO Guide for the Development of Bicycle Facilities – refer to section on shared-use paths
- TDEC – refer to water resources permitting for regulations regarding the alteration of riparian areas: www.tn.gov/environment/permits/arap.shtml
- TVA website – refer to this for resources on riparian restoration: www.tva.com/river/landandshore/stabilization/index.htm

MULTI-USE TRAIL BRIDGES

Saddle Bag Bridge

Road Companion Bridge

Active Rail Companion Bridge

MINOR PEDESTRIAN BRIDGES

Stone Slab

Recreational Wood Bridge

Freestanding Bridge

Rope Bridge

A4 TRAILS CROSSING OVER

BOARDWALKS

Floating Boardwalk

Wet Anchored Boardwalk

Dry Anchored Boardwalk

WET HABITAT CROSSING

Boardwalk in Low Area

Concrete Crossing

Culverts

Weir

CROSSING OVER

When a trail passes over shallow water or another sensitive environmental area, such as a wetland, boardwalks should be used to maintain the site's ecological integrity. Boardwalks may be designed to include viewing platforms and outdoor classrooms.

In some cases, it may be important to ensure that wildlife are able to safely cross the trail. Small culverts built under trails ensure safe passage for amphibians, while low-water fords and weirs provide passage for aquatic life as well as trail users.

B1 TRAIL SURFACE MATERIALS

INTRODUCTION

Appropriate surface materials help create a safe and accessible trail. Many options are available to suit a variety of cost, maintenance, and user needs.

The matrix at the right summarizes surface material selections for typical trail types and some use and site maintenance factors for trail design professionals to consider when selecting materials for trail surfaces. When comparing options for trail materials, plantings and construction, it is important to include both the initial costs of construction and installation, and the later costs of maintenance, repair and replacement over the lifetime of the trail to arrive at total **life-cycle costs** for each option. Beyond cost, trail designers should also consider choosing materials that are locally available, sustainably harvested and evoke the East Tennessee sense of place. For example, the Visual Index shows many examples where local limestone is used to create attractive walls, bridges, pavements, benches and shelters.

RESOURCES

- Multi-use Trail Surfacing Options – refer to this PDF for information on materials maintenance, durability, and cost: http://atfiles.org/files/pdf/AltaTrailSurface.pdf

TRAIL SURFACE MATERIALS SELECTION MATRIX

● STRONGLY RECOMMENDED
◒ PARTIALLY RECOMMENDED
◌ LOW
⬡ MEDIUM
⬢ HIGH
\+ EXHIBITS CHARACTERISTIC

		MULTI–USE TRAILS						RECREATIONAL TRAILS			ABOVE GRADE CROSSINGS		
		CONCRETE	ASPHALT	PERMEABLE PAVEMENTS	UNIT PAVERS	RUBBERIZED TRACK	COMPACTED SOIL	CRUSHER FINES	WOODCHIPS	TURFGRASS	WOOD DECKING	CONCRETE DECKING	METAL GRATE
TRAVEL MODES	ADA APPROVED SURFACE	●	●	●	◒	●	◒	◒			●	◒	◒
	RUNNING	◒	●	◒	◒	●	◒	◒	◒	◒	●	●	●
	HIKING		◒				●	●	●	◒	●	●	◒
	BICYCLE–RECREATIONAL						●	●	◒	◒	◒		◒
	BICYCLE–COMMUTER	●	●	●	◒							●	
	EQUESTRIAN						●		●		●	●	
USE ON RUNNING SLOPE	< 2% Slope	●	●	●	●	●	●	●	●	●	●	●	●
	2–8% Slope	●	●		●	◒	●	◒		●	●	●	
	> 8% Slope		●		●		◒						
SURFACE PERMEABILITY	HIGHLY PERMEABLE			+	+			+	+	+	+		+
	SEMI–PERMEABLE				+		+					+	
	IMPERVIOUS	+	+			+						+	
LOCATION	URBAN NON–RESIDENTIAL	●	●	●	●	●						●	●
	URBAN RESIDENTIAL	●	●	●	●	●		◒				●	●
	SUBURBAN NON–RESIDENTIAL	●	●	●	●	●		◒				●	●
	SUBURBAN RESIDENTIAL	●	●	●	●	●	●	●	◒		●	●	●
	RURAL		●	●			●	●	●	●	●	●	●
MONETARY FACTORS	COST	⬡	◌	⬡	⬢	⬢	◌	◌	◌	◌	⬡	⬢	⬢
	MAINTENANCE	◌	⬡	⬢	⬡	⬡	⬡	⬡	⬡	⬢	⬡	◌	◌
	DURABILITY	⬢	⬡	⬡	⬡	◌	◌	◌	◌	n/a	⬡	⬢	⬢

B_2 TYPICAL TRAIL SURFACE MATERIALS

ACCESSIBLE TRAIL

Concrete is an attractive, durable material for high-traffic areas or flood-prone areas.

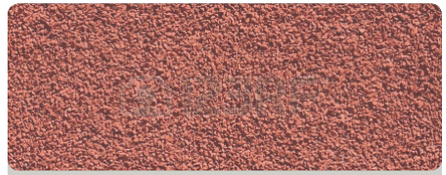
Cost: $$
Maintenance: Low
Durability: High

Unit Pavers are an attractive, permeable option for amenity sites.

Cost: $$$
Maintenance: Low-Medium
Durability: Medium-High

Asphalt is an economical, durable material that withstands high traffic.

Cost: $
Maintenance: Medium
Durability: Medium-High



Rubberized Track is an appropriate choice for pedestrian-only recreation loops.

Cost: $$$
Maintenance: Low-Medium
Durability: Medium-Low

Permeable Pavements have similar characteristics as impervious versions yet prevent pooling/icing.

Cost: $$
Maintenance: High
Durability: Medium-High

Compacted Soil is a low-cost option for pedestrian and equestrian trails. Made ADA accessible by top-sealing.

Cost: $
Maintenance: Medium
Durability: Medium-Low

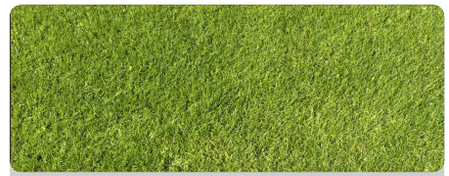
RECREATION TRAIL

Crusher Fines are an economical choice for recreational pedestrian and bicycle trails.

Cost: $
Maintenance: Medium-High
Durability: Medium-Low

Woodchips are an economical choice for recreational pedestrian trails.

Cost: $
Maintenance: Medium-High
Durability: Medium-Low



Turf Grass strips provide a low-cost trail surface for recreational activities.

Cost: $
Maintenance: High
Durability: n/a

BOARDWALKS & BRIDGES

Wood Decking may be used for crossings, but may become slippery when wet.

Cost: $$
Maintenance: Medium
Durability: Medium-High

Concrete Decking is a durable, slip-resistant material for crossings.

Cost: $$$
Maintenance: Low
Durability: High

Metal Grating is an attractive, low-maintenance, slip-resistant option for crossings.

Cost: $$$
Maintenance: Low
Durability: High

B3 TYPICAL MATERIALS FOR INCLINES

RAMPS, STEPS, HANDRAILS

The right choice of materials for ramps, steps and handrails will provide safe surfaces for a variety of users.

Factors that influence material selection for ramps, steps, and handrails include accessibility needs, location of installation, frequency and type of use, local code requirements, durability, maintenance and cost.

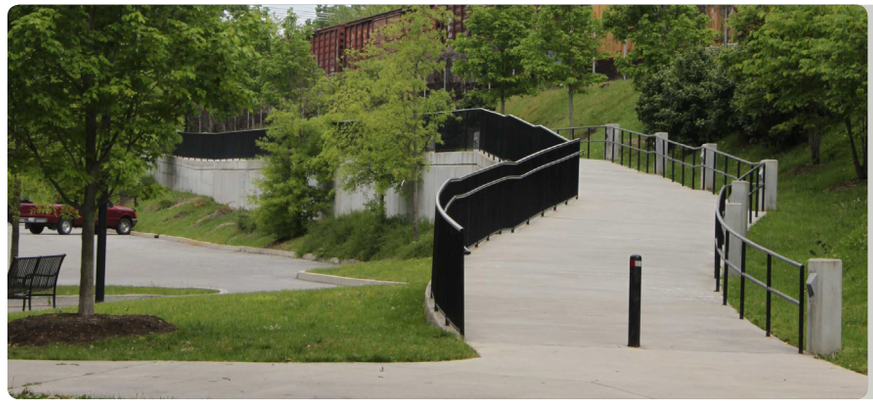
When considering costs it is important to include both the initial cost of construction and installation, as well as the costs for maintenance, repair and replacement over the effective lifetime – this is called the total **life cycle cost**. Beyond cost, trail designers should also consider choosing materials that are locally available and evoke the East Tennessee sense of place.

See Chapter 2 Trail Design for additional information on ramps and steps.

See Appendix D for information on guardrails.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for requirements on materials, ramp design, and handrails

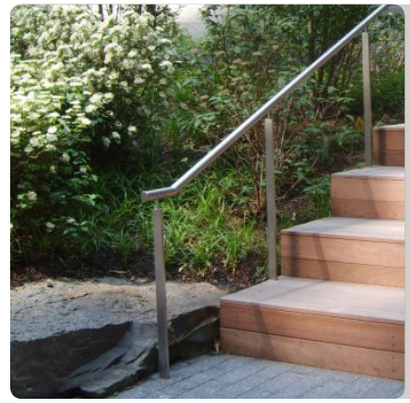


Concrete Ramp

Wood & Gravel Steps

Concrete Steps

Wooden Handrail



Metal Handrail

ACCESSIBLE RAMPS

It is important to include universally accessible greenway segments wherever conditions permit. If a route or trail is designated as universally accessible, accessible ramps are required at grade changes. Handrails and guards that accompany an accessible ramp must also meet Americans with Disabilities Act (ADA) accessibility design standards. Concrete and asphalt are appropriate choices for accessible ramps.

STEPS

Steps cannot replace required accessible ramps at grade changes on accessible routes, but are often included with the ramp. On trails segments too steep for universal access, steps can improve footing at steep grade changes. Materials such as railroad ties, cast concrete, and stone slabs make ideal steps and landings. Steps should only be used in addition to ramps to meet ADA requirements.

HANDRAILS & GUARDS

Handrails and guards provide safety and are a decorative opportunity. **Guards** include rails, walls, curbs and other barriers designed to reduce the chances of slipping off of or falling over the edge of an elevated surface. **Handrails** are rails that provide a grip for a person's hand. Handrails and guards should be designed in accordance with accessible design and building standards.

B4 TYPICAL MATERIALS FOR MAINTENANCE AREAS

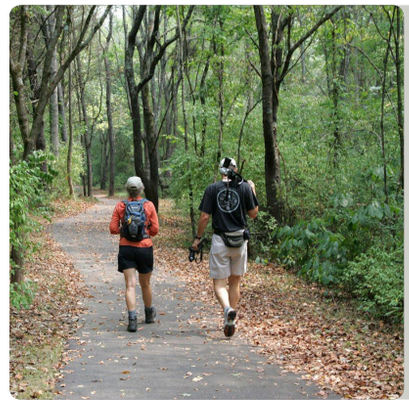
LEVEL AREAS

Turf Grass

Native Meadow

Ornamental Planting

SLOPED AREAS



Geotextile & Native Plants

Rock Terrace

Segmented Retaining Wall

STEEP AREAS

Retaining Wall

Terrace Garden

Vegetated Wall

MAINTENANCE AREA & TRAIL SHOULDER MATERIALS

ADA accessible greenway trails include a 2-foot-wide area on either side of a trail that is kept clear of obstacles – this area is referred to as the **shoulder.** The wider area on either side of a trail where vegetation is kept low and trimmed back for safety, visibility and fire suppression is referred to as the **maintenance area**.

Materials used in maintenance areas and shoulders distinguish trails from surrounding areas, aid in wayfinding, and help keep soils stable.

For level maintenance areas, turf grass and native plantings are appropriate choices. For sloped areas, soil-stabilizing materials such as geotextiles and deep-rooted native plants are ideal, as are terraces.

For steeply sloped areas, retaining walls may be necessary. Attractively planted retaining walls and free standing 'living walls' or vines on fences in the maintenance area can improve wayfinding by adding interest and landmarks to trailside views.

For more information regarding native plantings that are appropriate for maintenance areas, refer to Appendix C.

C1 SIGNAGE & SIGNALS – TYPES

INTRODUCTION

Signage and signals are used to aid way-finding and to increase the safety of trail users.

Regions or communities usually identify a set of typical signs, infrastructure and amenities to help unify wayfinding and lets users know when they are in the greenway system. Design guideline documents are an easy way to make examples and guidelines available digitally or in print. Including decorative variations on the typical signage, infrastructure and amenity selections in the design guidelines helps communicate character and theme of corridor segments, and can let users know when they are in a particular community or corridor segment type.

Two local examples of signage guidelines are listed in the resources – the Knoxville Regional Transportation Planning Organization Greenway Signage Guidelines (see Appendix E) and the 2012 Downtown Knoxville Wayfinding & Signage Program. It is important that greenway signage designs comply with all relevant local, state, and national standards for signage. Local Metropolitan Planning Organizations or Transportation Planning Organizations (MPOs/TPOs) or the Tennessee Department of Transportation (TDOT) may be able to provide information or assistance with signage standards to a community.

POST MOUNTED


Standard Post

Decorative Post


Projecting Sign / Banner

SPECIALTY


Kiosk


Pavement – Painted

Building Mounted

Pylon Sign

Monument Sign

Creative Signs

C2 SAFETY SIGNAGE & SIGNALS

G

DIRECTED AT DRIVERS

Trail Crossing Signage

Rapid Rectangular Flashing Beacon

Crosswalk Signage

Motor Vehicles Prohibited

Crosswalk Striping

HAWK Beacon System

DIRECTED AT GREENWAY USERS

Crossing Approach

Warning Signage

Trail Striping

SAFETY SIGNAGE & SIGNALS

The right choice of signage and signals helps trail users safely interact with other elements of the transportation network, such as roads and rail lines. Potential for safe interactions is greatly enhanced when graphically clear and simple signage is provided to both trail users and motorists. Refer to Visual Index A for more information regarding trail crossings.

Carefully considered signage can also help maintain harmony between different types of trail users: cyclists, equestrians, and pedestrians of all speeds.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – requirements on sign height, text size, background color, and contrast
- AASHTO Guide for the Development of Bicycle Facilities
- CPTED guidelines: www.humanicses.com/cpted.pdf
- MUTCD – refer to this for information on signage at crossings: www.mutcd.fhwa.dot.gov/pdfs/2009r1r2/pdf_index.htm

C3 WAYFINDING SIGNAGE

WAYFINDING SIGNAGE

Wayfinding signage has a strong impact on user experiences and ease of use for a greenway system. Online resources, such as hours of operation, links to nearby amenities, and greenway system maps, help users prepare for a day on the trails. Large maps at key trail locations and trailside directional signage keep users from getting lost and reassure them they are headed in the right direction. Digital maps on smart phones provide users instant access to trail information and reduce the funds spent on paper maps.

Mile markers not only help users keep track of distance traveled on a trail, but they also provide important location information to direct emergency assistance and maintenance workers. For more information on Mile Marker Guidelines, see Appendix B.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities
- 2012 Downtown Knoxville Wayfinding & Signage Program
- AASHTO Guide for the Development of Bicycle Facilities
- Knoxville Regional Transportation Planning Organization (TPO) Greenway Signage Guidelines

ON THE GREENWAY

Route & Trail Maps

Mile Markers

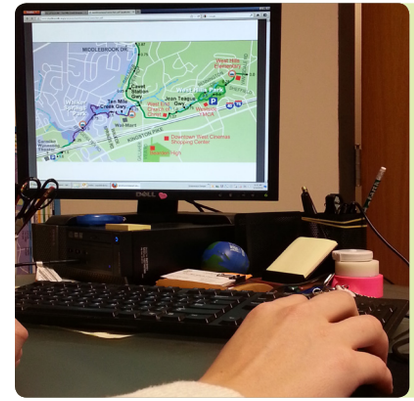
Trailhead Marker

Amenity Notification

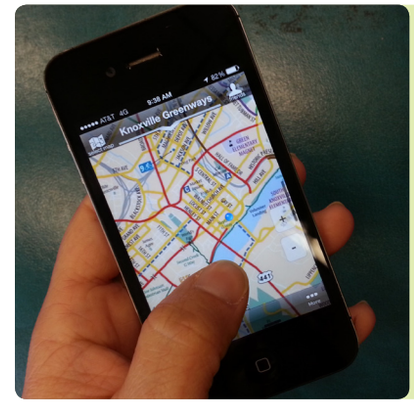
Directional / Distance Sign

Street Signs

ON THE WEB



Online Tools



Phone Apps

C4 HISTORICAL & EDUCATIONAL SIGNAGE

G

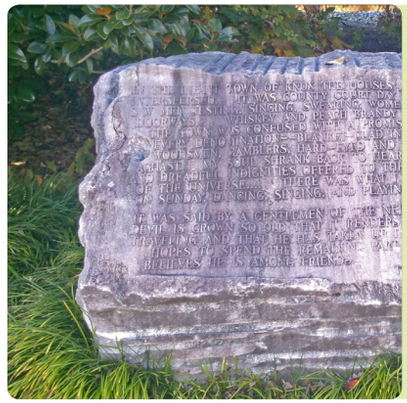
STANDARD

CREATIVE AND DECORATIVE

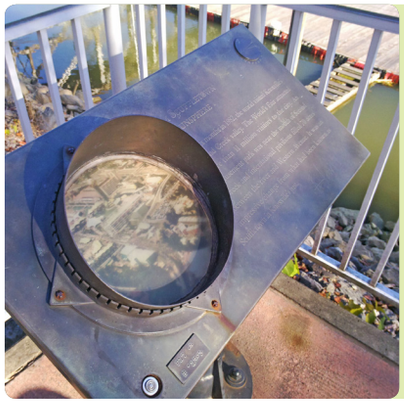
Text-Only Sign

Integrated into Amenity

Text with Pictures



Integrated into Landscape



Interactive with Audio

Integrated into Landscape

HISTORICAL & EDUCATIONAL SIGNAGE

Greenway trails often pass through areas with historical significance or locations with educational opportunities.

Thoughtful, well-designed online and trail signage can enrich a user's experience and deepen his appreciation for East Tennessee's rich cultural heritage.

Refer to Visual Index F for more information regarding cultural, commercial, and educational amenities that can be located along a greenway corridor.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – requirements on sign height, text size, background color, and contrast

D_1 TRANSITION ZONES: BUFFERS, BARRIERS & BORDERS

INTRODUCTION

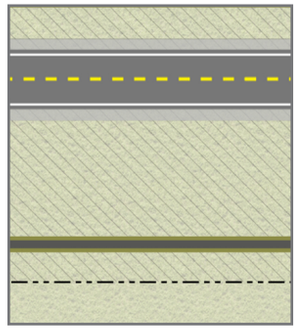
Buffers, barriers and borders are transition features that help greenway corridors be a good neighbor to adjacent uses and waterways. The diagram at the right illustrates typical locations for trails or trail easements in road or rail right-of-way, utility easements, waterside areas, next to private property lines, or in open-space parks. Below the illustration, types of buffers, barriers, and borders that may be appropriate for each typical location are listed.

RESOURCES

- AASHTO Guide for the Development of Bicycle Facilities – refer to this for guidance on trail placement within road ROW
- Tennessee Parks and Greenways Foundation – refer to website for more information on conservation easements: www.tenngreen.org

EASEMENTS, RIGHTS-OF-WAY & PRIVATE PROPERTY

ROADSIDE

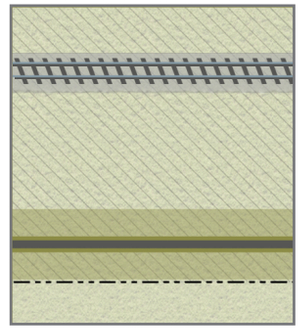


BUFFERS
Safety
Aesthetic

BARRIERS
Safety
Trespass

BORDERS
All

RAILSIDE

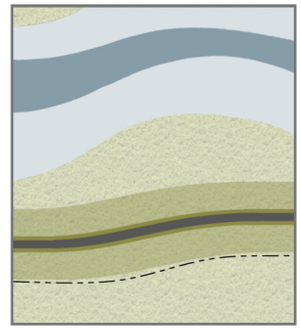


BUFFERS
Safety
Aesthetic

BARRIERS
Safety
Trespass

BORDERS
All

WATERSIDE

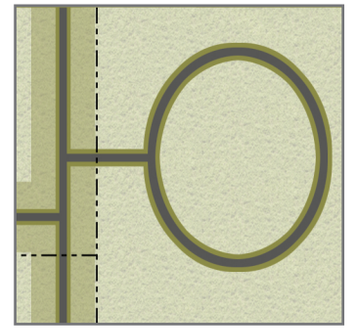


BUFFERS
Water Quality
Habitat

BARRIERS
Safety
Trespass

BORDERS
All

PRIVATE PROPERTY



BUFFERS
Aesthetic (privacy)

BARRIERS
Trespass

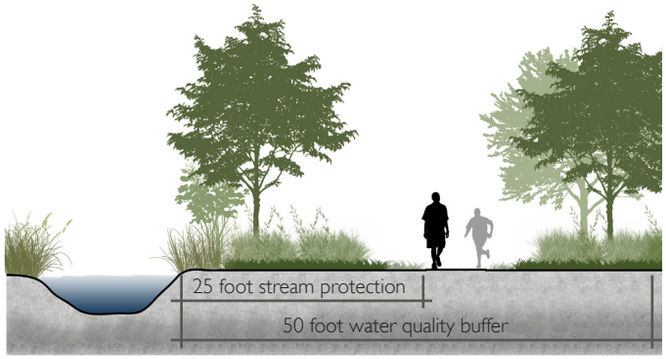
BORDERS
All

D2 BUFFERS

MULTI-USE BUFFERS

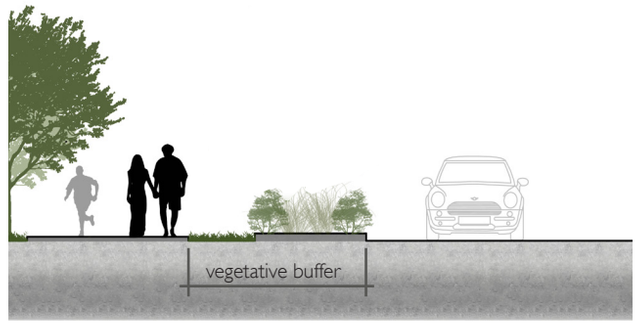
In the above section, multiuse buffers, depicted in green, surround two trails and provide water quality protection, privacy, habitat, air quality improvements, and aesthetic quality.

WATER QUALITY BUFFERS



To protect streams from excessive runoff, contamination, and erosion, a 50-foot minimum water quality buffer is recommended between the outer edge of a stream bank and adjacent development. Greenway trails may be located within the 50-foot buffer but not within 25 feet of the stream bank. Buffers along watersides provide ideal locations for trails and serve multiple other purposes, including wildlife habitat, improved air quality, and temperature regulation.

SAFETY BUFFERS



Safety buffers may be used to create separation between greenway trails and incompatible adjacent uses. A low vegetative buffer between a sidepath and the adjacent street creates a more comfortable setting for trail users. If there is not space for a horizontal buffer, a vertical barrier such as a curb, guardrail, or jersey barrier is needed.

BUFFERS

Buffers are continuous features, such as maintained vegetation, that mediate between adjacent uses, and often serve multiple purposes. Buffers may screen unwanted views and sounds, or provide protection from incompatible adjacent uses. Buffers may also contribute to water and air quality and include areas for wildlife habitat. Multi-use buffers perform multiple services (top left). Water quality buffers (lower left) are mixed vegetation buffers of trees, shrubs, grasses, sedges, often native to the area, that are allowed to mature to their full height. Safety buffers (lower right) provide separation between greenway trails and adjacent uses to increase the safety of trail users.

RESOURCES

- Rails to Trails Conservancy – find resources for designing safe rails-with-trails here: www.railstotrails.org/ourWork/trail-building/toolbox/informationSummaries/rails-with-trails.html
- TDEC – refer to water resources permitting for regulations on altering riparian areas: www.tennessee.gov/environment/water
- TVA website – refer to this for resources on waterside restoration: www.tva.com/river/landandshore/stabilization/index.htm

D3 BARRIERS

BARRIERS

Barriers improve safety, discourage trespass, and promote privacy by impeding physical access between areas of incompatible use within the greenway corridor. Safety barriers include walls, rails, and other elements that meet transportation safety specifications. Privacy and trespass barriers include fences, walls, and plantings that screen sightlines. They also limit transmission of sound and physical access to property located adjacent to the trail corridor. Bollards allow trail users to pass, but prevent unauthorized vehicles entering. However, bollards may pose a hazard to bicyclists. For guidance on when and how to use bollards, see Appendix E: TPO Guidelines for Signing and Marking Greenway Trails.

RESOURCES

- AASHTO Guide for the Development of Bicycle Facilities
- Crime Prevention Through Environmental Design (CPTED) guidelines: www.humanics-es.com/cpted.pdf
- Rails to Trails Conservancy – find resources for designing safe rails-with-trails here: www.railstotrails.org/ourWork/trailbuilding/toolbox/informationSummaries/rails-with-trails.html

SAFETY BARRIERS

Vehicular Guardrail

Railing

Bollards

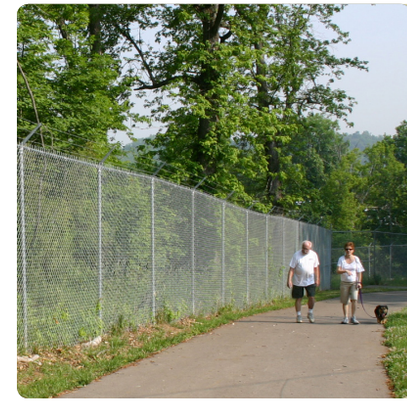
PRIVACY & TRESPASS PREVENTION BARRIERS

Topography & Vegetation

Vegetation Screen & Wall

Fence

Vegetation & Fence



Vegetation & Fence

Split Rail Fence

D4 BORDERS

WAYFINDING LANDMARKS

Specimen Plantings

EDUCATION BORDER

Habitat Signage

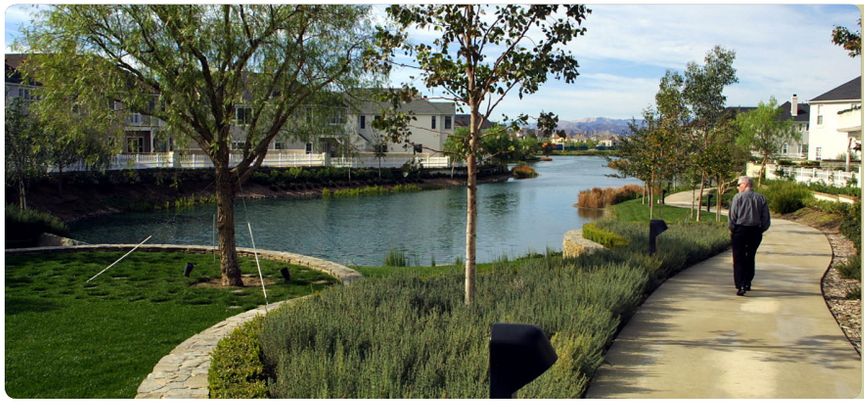
PRIVACY BORDER

Tall Ornamental Planting

Border Lighting

Natural Play Areas

Tall Ornamental Planting



Coordinated Materials

BORDERS

A border is a planted zone in the trail maintenance area that adds amenity to the greenway experience. Borders are primarily located at trailheads, rest points, scenic overlooks, or other points of interest. Borders can be combined with barriers or buffers to reinforce wayfinding, create focal points, add educational value, or attract birds, butterflies, and other wildlife to the trail side.

Borders can be effectively combined with art, landmarks, wayfinding and educational signage to enrich the user experience while contributing to the privacy of adjacent uses.

For more information regarding native plantings that are appropriate for borders, refer to Appendix C.

E1 LIGHTING

INTRODUCTION

On trails where night use is permitted, the right lighting helps create a safe and accessible experience for all users. Many options are available to suit a variety of cost, maintenance, and user needs. Trail designers should consider lighting fixtures that minimize spill light – light from a fixture that falls outside the boundaries of the property on which it is located. Lighting fixtures that meet Dark Sky guidelines should be considered, particularly in residential, mixed-use, and rural areas. Dark Sky compliant lighting fixtures include shielding to reduce spill light both above and to the sides of the fixture.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for requirements on fixture size, location, and projection into the path
- Crime Prevention Through Environmental Dedsign (CPTED) – refer to this PDF for an understanding of how lighting can aid in crime prevention: www.humanics-es.com/cpted.pdf
- Dark Sky Guidelines – refer to these simple guidelines to select fixtures that help reduce spill light; for more information see: darksky.org

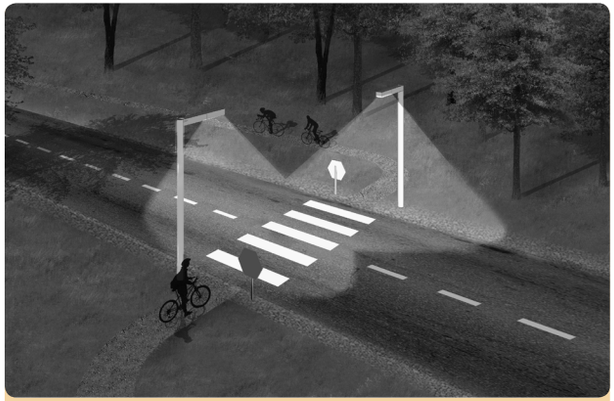
TRAIL LIGHTING MATRIX

● STRONGLY RECOMMENDED
◒ PARTIALLY RECOMMENDED

		SECURITY LIGHTING		USER LIGHTING		MAINTENANCE AREA LIGHTING				FOOTPATH LIGHTING				
		ROADWAY LIGHTING	PARKING LOT LIGHTING–SHIELDED	PEDESTRIAN POLE LIGHT–STANDARD	PEDESTRIAN POLE LIGHT–DECORATIVE	LANDMARKS, WALLS, SIGNAGE	LOW–LEVEL FLOOD LIGHTS	BOLLARD LIGHTS	IN–GRADE ARCH. LIGHT FIXTURES	LOW–LEVEL FLOOD LIGHTS	RECESSED WALL LIGHTS	STEP LIGHTS	BENCH LIGHTS	CREATIVE LIGHTS
RURAL	MAJOR TRAILHEAD		●	◒		◒								
	MAJOR TRAILHEAD AT NON–RESIDENTIAL		◒	◒	◒									◒
	MINOR TRAILHEAD				●	◒		◒						◒
	STANDARD TRAIL SEGMENT													
	STANDARD TRAIL CROSSING TRAIL			◒										◒
	STANDARD TRAIL CROSSING ROADS OR RAILS	●												
SUBURBAN RESIDENTIAL	MAJOR TRAILHEAD		●	◒	◒	◒		◒						◒
	MAJOR TRAILHEAD AT NON–RESIDENTIAL			◒	●	◒		◒						◒
	MINOR TRAILHEAD													
	STANDARD TRAIL SEGMENT			◒										◒
	STANDARD TRAIL CROSSING TRAIL													
	STANDARD TRAIL CROSSING ROADS OR RAILS	●												
SUBURBAN COMMERCIAL	MAJOR TRAILHEAD		◒	●	●	◒		◒						◒
	STANDARD TRAIL SEGMENT			◒	●	●	◒		◒	◒		◒	◒	◒
	STANDARD TRAIL CROSSING TRAIL			◒	●	●	◒		◒	◒		◒	◒	◒
	STANDARD TRAIL CROSSING ROADS OR RAILS	●				●								
URBAN RESIDENTIAL	MAJOR TRAILHEAD		●	◒	◒	◒		◒						◒
	MINOR TRAILHEAD			◒	●	◒		◒						◒
	STANDARD TRAIL SEGMENT													
	STANDARD TRAIL CROSSING TRAIL			◒	●			◒						◒
	STANDARD TRAIL CROSSING ROADS OR RAILS	●						◒						
URBAN COMMERCIAL	MAJOR TRAILHEAD		●	●	●	◒		◒		◒	◒	◒	◒	◒
	STANDARD TRAIL SEGMENT			◒	●	●	◒		◒	◒	◒	◒	◒	◒
	STANDARD TRAIL CROSSING TRAIL			◒	●	●	◒		◒	◒				
	STANDARD TRAIL CROSSING ROADS OR RAILS	●		◒	●	●	◒	◒						◒
SPECIAL TRAIL PLACES	LEARNING LANDSCAPES					●								◒
	SCENIC PLACES												◒	
	EVENT PLAZAS			◒	●	●	●		●	●	●	●	●	●
	POCKET PARKS			◒	◒									◒
	EMERGENCY CALL SITES			◒	●									

E_2 EXAMPLE LIGHTING LOCATIONS

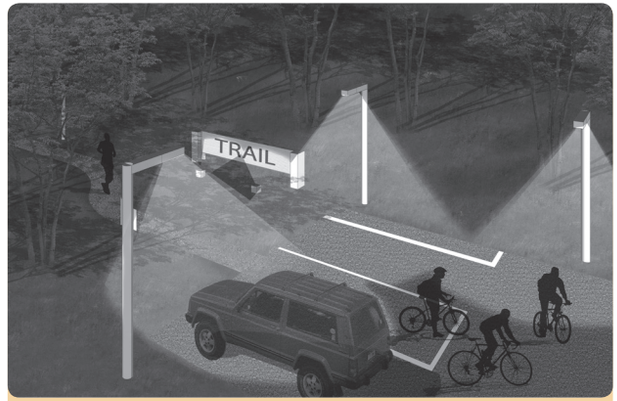
ROADWAY CROSSROADS



Potential Fixtures

- Tall: Roadway

MAJOR TRAILHEAD



Potential Fixtures

- Medium-Height: Decorative Pedestrian
- Tall: Shielded Parking Lot
- Specialty: Landmark, Wall, & Signage

TRAIL CROSSROADS

Potential Fixtures

- Medium-Height: Standard Pedestrian / Decorative Pedestrian
- Specialty: Landmark, Wall, & Signage / Bench

URBAN TRAIL

Potential Fixtures

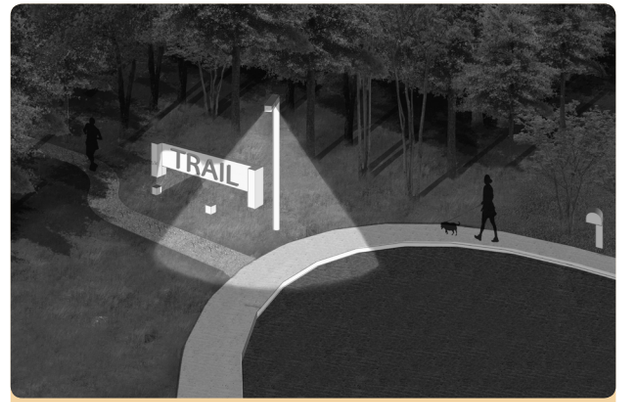
- Short: Bollards / Low Level Flood
- Medium-Height: Standard Pedestrian / Dec. Pedestrian
- Specialty: In-Grade / Landmark, Wall, & Signage / Bench / Step

AMENITY LOCATION

Potential Fixtures

- Medium-Height: Standard Pedestrian / Decorative Pedestrian / Creative
- Specialty: Landmark, Wall, & Signage / Bench

MINOR TRAILHEAD



Potential Fixtures

- Medium-Height: Standard Pedestrian / Decorative Pedestrian
- Specialty: Landmark, Wall, & Signage

E3 EXAMPLE LIGHT FIXTURES

SHORT FIXTURES

Bollards can provides even light on the surface of the path.
Maintenance: medium
Cost: $

Bollards can provide even light on the surface of the path in multiple directions. Can also highlight landscape features.
Maintenance: Medium
Cost: $

Bollards provide even light on the path surfaces. Use of reflective top reduces glare and light pollution.
Maintenance: medium
Cost: $$

Low Level Flood Lights provide light across path surfaces.

Maintenance: low
Cost: $

MEDIUM-HEIGHT FIXTURES

Standard Pedestrian Poles provide lighting on path surfaces and users' faces. Height makes lamp a difficult target for most vandals.
Maintenance: low
Cost: $$

Standard Pedestrian Poles provide lighting on path surfaces and users' faces. Height makes lamp a difficult target for most vandals.
Maintenance: low
Cost: $$

Decorative Pedestrian Poles provide even, soft lighting on path and users' faces. Height makes lamp a difficult target for most vandals.
Maintenance: low
Cost: $$$

Creative Lighting provides focused lighting to highlight a special tree or object. Adjust location to accommodate tree growth.
Maintenance: high
Cost: $$

E4 EXAMPLE LIGHT FIXTURES

TALL FIXTURES

Roadway Lighting provides light surrounding the intersection between path and road or rail line.
Maintenance: low
Cost: $$

Shielded Parking Lot Lighting provides lighting on surface of trail parking lot and users' faces.
Maintenance: low
Cost: $$

Decorative Shielded Parking Lot Lighting provides lighting on surface of trail parking lot and users' faces.
Maintenance: low
Cost: $$$

Shielded Parking Lot Lighting provides lighting directed at specific areas of path and parking lot.
Maintenance: low
Cost: $$

SPECIALTY FIXTURES

In-Grade Architectural Lighting provides lighting directed at a specific feature.
Maintenance: low
Cost: $

Landmark, Wall, & Signage Lighting provides lighting directed at a specific feature.
Maintenance: low
Cost: $

Bench Lighting Provides lighting for safety and comfort at an amenity location where users rest and linger.
Maintenance: medium
Cost: $$$

Step Lighting provides lighting on surface of steps for safety and ease of use.
Maintenance: medium
Cost: $$

F1 AMENITIES

INTRODUCTION

The experience of greenway users can be greatly enhanced by the careful location of amenities. This index provides a brief overview of the types of amenities that can be considered when designing a greenway trail. In locations where a trail links to a transit stop (or where a transit stop is likely in the future) a shelter for use by both trail users and transit users is strongly recommended.

A sponsored trailhead has signage or amenities provided by a local business.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for requirements on parking configuration and accessibility standards for restrooms and benches
- Crime Prevention Through Environmental Design (CPTED) – refer to this PDF for an understanding of how amenity design can aid in crime prevention: http://www.humanics-es.com/cpted.pdf

TRAIL AMENITIES MATRIX

● STRONGLY RECOMMENDED
◒ PARTIALLY RECOMMENDED
R RECOMMENDED for RURAL

		SAFETY, CONVENIENCE, + PARKING					WELFARE + SANITATION					REST + SHELTER			EXCERCISE + RECREATION		
		CONVENIENT STORAGE	BICYCLE PARKING	ELECTRIC BICYCLE CHARGING STATION	EMERGENCY STATIONS	HORSE PARKING	WATER FOUNTAIN dog/people	RESTROOM	DOG SANITATION STATION	CHANGING + SHOWER AREAS	WASTE + RECYCLING RECEPTACLES	SEATING	SHELTER	SHADE	FITNESS EQUIPMENT	PLAYFUL AMENITIES	POCKET PARKS
RURAL	MAJOR TRAILHEAD		◒		◒	●	◒	●			●	●		●			
	MAJOR TRAILHEAD AT NON–RESIDENTIAL	◒	●		◒					●	●		●				
	MINOR TRAILHEAD		◒		◒	●	◒				◒	●		●			
	STANDARD TRAIL SEGMENT											●		●			
	STANDARD TRAIL CROSSING TRAIL											●	◒	●			
	MID–TRAIL EMERGENCY SITE											●	◒	●			
SUBURBAN	MAJOR TRAILHEAD		●	◒	◒		◒	◒	●		●	●		●			
	MAJOR TRAILHEAD AT NON–RESIDENTIAL	◒	●	◒							●	●		●			
	MINOR TRAILHEAD		●		◒		◒	◒	◒		◒	●		●	◒	◒	◒
	STANDARD TRAIL SEGMENT											●		●			
	STANDARD TRAIL CROSSING TRAIL									◒			●		◒	◒	
	MID–TRAIL EMERGENCY SITE				●							●	◒	●			
URBAN	MAJOR TRAILHEAD	◒	●	◒	◒		◒	◒	●	◒	●	●	◒	●	◒	◒	
	MAJOR TRAILHEAD AT NON–RESIDENTIAL	●	●	◒	◒				●	◒	●	●		●		◒	
	MINOR TRAILHEAD	◒	●	◒					●		●	●		●	◒	◒	◒
	TRAILHEAD (SPONSORED)	●	●	◒	●		●	●	◒	●	◒	●	●	●	◒	◒	◒
	STANDARD TRAIL SEGMENT		◒									●		●			
	STANDARD TRAIL CROSSING TRAIL									◒	◒	●		●	◒	◒	
	MID–TRAIL EMERGENCY SITE			◒								●					
SPECIAL TRAIL PLACES	LEARNING LANDSCAPES		●			R					◒	●		●		◒	◒
	SCENIC PLACES		●			R	◒	◒	◒		◒	●	R	●			
	EVENT PLACES		●	◒	◒	R	●	●	●		●	●	●	●		●	

F2 ENRICHMENT PLACES & ECONOMIC OPPORTUNITIES

ART

Art on Infrastructure

Art on Infrastructure

Art as Landmark

LEARNING

Historical & Cultural Markers

Agriculture Markers

Habitat Markers

COMMERCIAL OPPORTUNITIES

Seasonal Amenities

Bike Tours

Adjacent Businesses

ENRICHMENT PLACES & ECONOMIC OPPORTUNITIES

Activities and amenities in greenway corridors attract a variety of visitors, such as history buffs, wildlife watchers, exercise enthusiasts, tourists, and day visitors. When planning trails, communities should consider including short routes to connect business areas to trails. Entrepreneurial ventures that benefit from greenways include:

SEASONAL & POP-UP MARKETS

- Farm stands
- Watersport rental
- Food truck plazas

TOURS

- Bike tours
- Walking tours (for example, Old Gray Cemetery Carriage & Lantern Tour)
- Equestrian trails
- Canoe or kayak tours
- Ghost tours

ADJACENT BUSINESSES

- Restaurants, cafes & snack shops
- Riding stables
- Campsites & RV camps
- Bait & outfitters shops
- Lodging / Bed & Breakfasts
- Bicycle sales, repair, and rentals

F3 SAFETY, CONVENIENCE & PARKING

SAFETY, CONVENIENCE & PARKING

The inclusion of parking or storage facilities for bicycles, horses, or gear is a simple way to increase the flexibility of a greenway trail and encourage greater use. For example, a trailhead located near a town center or suburban shopping location is an ideal place for bike storage. Bicycle storage near employment centers is also useful.

Provision should be made for the location of amenities such as call stations and bike repair stations that address emergency situations.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for requirements on parking configuration
- AASHTO Guide for the Development of Bicycle Facilities
- Crime Prevention Through Environmental Design (CPTED) guidelines: www.humanics-es.com/cpted.pdf
- Vermont Pedestrian and Bicycle Facility Planning and Design Manual

STORAGE, BICYCLE PARKING & HORSE HITCHES

Bicycle Parking – Single Rack

Bicycle Parking – Lockers

Bicycle Parking – Multiple Racks

Bike Share

Bicycle Parking – Creative

Horse Hitching

EMERGENCIES

Call Station

Bike Repair Station

F4 WELFARE & SANITATION

HYDRATION

Water Fountain with Dog Bowl

Hydration Station

Water Station for Horses

RESTROOMS & CHANGING ROOM

Restroom – On-Grid

Restroom – Off-Grid

Changing Room

WASTE RECEPTACLES

Waste & Recycling

Dog Waste Bags

WELFARE & SANITATION

Greenways that are especially long or are located in more densely populated areas should consider including restroom facilities and water fountains. Restroom buildings located at trailheads can serve nearby amenities such as parks or event spaces. Composting toilets are good options for rural locations and can be designed to require relatively little maintenance.

If animals are allowed on the greenway, facilities should be provided for the disposal of pet waste. This can be as simple as providing waste bags and trash receptacles.

On greenway trails designed for heavy commuter use, and on recreational trails, shower and changing areas could be considered.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for accessibility standards for restrooms
- Crime Prevention Through Environmental Design (CPTED) guidelines: www.humanics-es.com/cpted.pdf

F5 REST & SHELTER

REST & SHELTER

Seating and shade are important amenities for the comfort of greenway users. Shade trees not only add comfort, but they can improve air quality as well.

Shade and seating can usually be provided at very low cost by the thoughtful placement of trees and the inclusion of occasional lawn areas, landscape berms or boulders along the path edge. Benches and picnic areas are welcome additions to trails in populated areas.

While shelter structures come in many forms, material selection and design of the shelters should reinforce the character and theme of each trail location as well as the overall greenway system. Care should be given to ensure shelters have open sightlines for the safety of users and are durable and easy to maintain.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for accessibility standards for benches and shelters
- Crime Prevention Through Environmental Design (CPTED) guidelines: www.humanics-es.com/cpted.pdf

SEATING

Architectural Site Walls

Benches

Boulders & Natural Benches

SHELTER

Bus Shelter

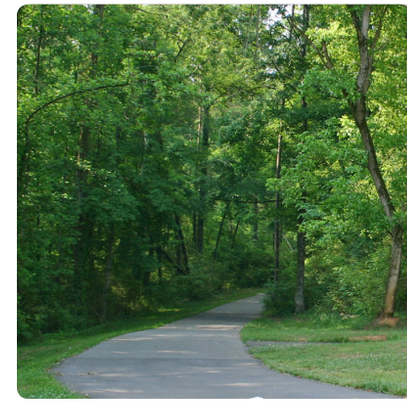
Picnic Pavilion

Rustic Shelter

SHADE

Street Trees

Pergolas & Trellis



Woodlot Clearing

F6 EXERCISE & RECREATION

FITNESS

Integrated into Infrastructure

Dedicated Fitness Loops

Blueway Put-ins

PLAYFUL AMENITIES

Fountains

Integrated into Path

Play Mounds
Integrated into Landscape

POCKET PARKS

Lunch Spots

Accessible (ADA) Playgrounds

Dog Parks

EXERCISE & RECREATION

Greenway trails are a great place to provide exercise and fitness opportunities to users of all ages. Amenities such as playgrounds, lunch spots, dog parks, and other exercise and recreation opportunities that suit a range of community budget and maintenance needs can be integrated into greenway corridor plans.

Exercise and recreation amenities don't have to be expensive or high maintenance. Children may have just as much fun running up and down grassy play mounds as they do on a climbing wall.

RESOURCES

- 2010 ADA Standards for Accessible Design, Chapter 10: Recreational Facilities – refer to this for accessibility standards for benches
- Crime Prevention Through Environmental Design (CPTED) guidelines: www.humanics-es.com/cpted.pdf

APPENDIX A // TRAIL MAINTENANCE RESOURCES

INTRODUCTION

The cost of maintenance should be considered during trail planning and design. Greenways can be costly to design and install, and developing a maintenance plan will ensure the investment is not wasted. Proper maintenance is also essential to user safety and access.

During the greenway planning and design phases, a comprehensive list of maintenance costs and responsibilities should be estimated. These should then be accounted for with clear commitments of funds, person hours, or volunteer efforts to maintain the trail in the coming years. Consider the following potential costs[1] when developing your trail-maintenance strategy:

SURFACE MATERIALS

In general, the higher the initial installation cost of the surface, the less maintenance it will require over time.[2] Aggregate and mulch trails are very economical to construct but require regular resurfacing, as well as special attention after severe weather events. Asphalt surfaces require less frequent resurfacing (every 8-15 years), but can develop cracks from differential settlement or heaves from root growth. Concrete paths are the most expensive to build and require the least maintenance. The Federal Highway Administration (FHWA) has guidance on maintaining trail surfaces for safety and mobility.[3]

TRAIL CLEARING

Trails should be cleared regularly by dedicated staff or dependable volunteers. Fallen branches, rocks, and discarded litter are potential hazards and discourage greenway use. Leaves and mud on hard-surface trails can be slipping hazards. In cases of fallen trees or large logs on natural-surface trails, a section may be removed equal to the width of the trail. This permits free passage by walkers and cyclists and discourages use by unauthorized vehicles.[4]

VEGETATION MAINTENANCE

Management of vegetation surrounding the trail may also be performed by staff or volunteers. Management strategies will vary depending on the individual landscape. Grasses require mowing and other groundcover plants need regular trimming or burning. Taller species should be trimmed to maintain visibility and safety. Trees should be pruned so they do not encroach on the walkway or obscure trail signage. Dying trees in the vicinity of the trail should be monitored and removed prior to falling. Active and preventative measures of vegetation maintenance include cultivating native species that will crowd out weeds and installing root barriers when the trail is constructed. Removal of poisonous plants and briars from natural-surface trails is especially important because users will walk around such obstructions causing erosion at trail edges.[5]

REPAIRS

Bridges, boardwalks, fences, guard rails, sign posts, retaining walls, and other structural greenway features must be regularly inspected for defects. Small repairs on such items are usually easy to accommodate. If neglected, defects in these features can pose safety hazards and require trails to be rerouted while repairs are completed. Maintenance for such items is less frequent than trail clearing or vegetation management.

AMENITY MAINTENANCE

When properly maintained, amenities help encourage greenway use. Amenities should be selected and planned based on what resources are available to keep them in working order. Public toilets and drinking fountains require almost daily attention. Waste and recycling bins must be emptied on a schedule consistent with the level of use of the greenway. Pet waste stations require periodic restocking and support preventative greenway maintenance by encouraging users to clean up after pets. Benches, lighting, and emergency call stations require less frequent maintenance, especially if durable fixtures are selected.

REFERENCES

1. Checklist of maintenance activities available in National Park Service's Handbook for Trail Design, Construction and Maintenance, Chapter 9. Accessed on 11/26/2013 at: www.nps.gov/noco/parkmgmt/ncttrailconstructionmanual1.htm
2. Trail surfaces overview from Rails-to-Trails Conservancy accessed on 11/26/2013 at: www.railstotrails.org/ourwork/trailbuilding/toolbox/informationsummaries/trail_surfaces.html
3. FHWA-SA-13-037, A Guide for Maintaining Pedestrian Facilities for Enhanced Safety, safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa13037/
4. National Park Service Handbook for Trail Design, Construction and Maintenance. (see 1).
5. From vegetation control article accessed on 11/26/2013 at: blueandwhitecrew.org/overseerinfo/vegetation.php

APPENDIX B // MILE MARKERS

MILE MARKER GUIDELINES

Mile markers are a popular form of wayfinding signage that provides guidance to trail users about how far they have traveled. Especially useful for runners, walkers, or cyclists who want to track their mileage, the markers can also assist maintenance crews in finding places in need of repair, and help guide emergency responders in case of an injury on the trail. Consider coordinating with local emergency responders so they know where the mile markers are located, as well as the trail access points for emergency vehicles.

Decisions to be made before beginning a mile marker project:

MARKER TYPE

Mile markers can be on signs on posts, or marked on the trail surface itself. Since post-mounted signs are located close to the trail, they must be mowed around by the trail maintenance crew. The posts can also prove easy targets for graffiti. Marking directly on the trail surface may wear faster and require more frequent replacement than signs. Consider the available maintenance resources on the trail in question before choosing the marker type.

- Markers on Wooden Posts: 6-inch by 6-inch wooden posts are a popular and inexpensive choice. Metal signs that are 5-inch x 10-inch fit posts this size and are easy to install.
- Markers on standard metal sign posts are typically hammered into the ground instead of digging holes and setting them in cement. You might be able to get advice and equipment from your local government's sign shop to help with installation. If you prefer to dig holes and use cement, follow the instructions for wooden posts above.
- Painting Markers on the Trail: Markers can be painted directly on hard-surface trails (asphalt or concrete). Be sure to choose a durable paint and use plastic or cardboard stencils for a neat installation.

WHAT TO INCLUDE ON THE MARKERS

A basic mile marker will just have the distance from the beginning of the trail. Other possible information includes the name or jurisdiction of the trail, emergency responder and maintenance phone numbers, and who sponsored the trail markers.

WHERE TO BEGIN AND END

Clearly define the beginning and end points before locating any markers. Where paths cross town, city, or county borders, work across jurisdictions to ensure everyone agrees to the same beginning and end points. Consider using signs or markers in different colors to denote different trails – this can be helpful in complicated situations where multiple trails or trail systems intersect. Finally, think about where future greenways are likely to go when choosing beginning and end points.

INTERVALS

Typical intervals to mark are ¼ and ½ mile.

MAINTENANCE

Maintenance expense should be included when considering the overall cost to install mile markers. Staff or volunteers will be needed to regularly survey the markers for wear and damage. Resources will also be required to replace or repair damaged markers in a timely manner.

OTHER CONSIDERATIONS

- Call Before You Dig: Follow the Tennessee One Call process to make sure that you avoid underground utilities when digging holes for post-mounted signs. Keep in mind that once Tennessee One Call has marked utilities, those markings are only good for a limited time.
- Keep All Signs and Posts at Least 2 Feet From the Trail: The Manual on Uniform Traffic Control Devices (MUTCD) states: "Where used on a shared-use path, no portion of a sign or its support shall be placed less than 2 feet laterally from the near edge of the path, or less than 8 feet vertically over the entire width of the shared-use path."
- Measuring the Trail: The process of installing markers starts with the measuring and marking of the greenway. Use a measuring wheel for consistency and mark the mile-marker locations with spray chalk; don't put markers that are meant to be temporary on the trail with paint, as they will last for a long time.

APPENDIX C // PLANT PALETTE

GUIDING PRINCIPLES

Proper plant material selection and design decreases maintenance, provides year-round beauty, and promotes wildlife habitat along greenway corridors. Plantings should be carefully matched to the surrounding context to promote safety and visibility. Native plant species are encouraged as they are adapted to regional conditions, generally require less maintenance, and enhance the regional aesthetic. To avoid the widespread loss of vegetation within a greenway corridor due to disease or insect infestation, consider using a variety of native plant species instead of a single species. In urban areas, where vegetation may be sparse, tree canopy that is either preserved or created along trails provides a significant portion of urban forest and provides communities with multiple environmental and aesthetic benefits.

PLANT PALETTES

The following palettes provide a sample of appropriate plants for site conditions commonly found along East Tennessee trails.

ADDITIONAL REFERENCES

AASHTO Guide for the Development of Bicycle Facilities – refer to this document for information about planting heights and restrictions along roadways and near intersections.

Knoxville Street Tree Master Plan – refer to document this for tree species recommendations and tree placement and spacing guidelines: archive.knoxmpc.org/plans/treeplan/index.htm

Landscaping with Native Plants: East Tennessee – refer to this PDF to learn about the benefits of native plants and for information on native plant species selection for various sites: www.se-eppc.org/pubs/east.pdf

TVA Riparian Restoration – refer to this website for information regarding planting along watersides: tva.com/river/landandshore/stabilization/index.htm

PLANTS FOR FULL-SUN OPEN SPACES

These low-maintenance species range from 12 to 48 inches in height. They thrive in full sun and are suitable for use in large open areas that will not be mown. Native plant meadows provide habitat for many bird and insect species.

Pictured: *Asclepias tuberosa*, Butterfly weed; *Echinacea purpurea*, Purple coneflower; *Rudbeckia fulgida*, Black-eyed Susan; *Schizachyrium scoparium*, Little blue stem

Not pictured: *Andropogon gerardii*, Big blue stem; *Andropogon ternarius*, Split beard bluestem; *Andropogon virginicus*, Broomsedge; *Chasmanthium latifolium*, River oats; *Eupatorium dubium*, Joe-Pye weed; *Liatris spicata*, Dense blazing star; *Panicum virgatum*, Switchgrass; *Solidago rugosa*, Rough stemmed goldenrod; *Sorghastrum nutans*, Indian grass

LOW PLANTS FOR MEDIANS AND PLANTING STRIPS

These hardy, low-growing species make an attractive addition to medians and planting strips between roads and trails.

Pictured: *Hypericum frondosum*, Golden St. John's Wort; *Muhlenbergia capillaris*, Pink muhly grass; *Rhus aromatica* 'Gro Low,' Gro Low Fragrant sumac; *Schizachyrium scoparium*, Little blue stem

Not pictured: *Asclepias tuberosa*, Butterfly weed; *Echinacea purpurea*, Purple coneflower; *Rudbeckia fulgida*, Black-eyed Susan

PLANTS FOR PART-SUN TO SHADE TRAIL SIDES

These species range in height from 12 to 72 inches and are good choices for the maintenance area along a forested segment of trail. Plant material closest to the trail should be of shorter height to promote visibility.




Pictured: *Callicarpa americana*, American beautyberry; *Carex pensylvanica*, Pennsylvania sedge; *Phlox divaricata*, Wild blue phlox; *Osmunda cinnamomea*, Cinnamon fern

Not pictured: *Calycanthus floridus*, Sweetshrub; *Chasmanthium latifolium*, River oats; *Euonymus americanus*, Hearts-a-bustin; *Heuchera americana*, Alumroot; *Hydrangea quercifolia*, Oakleaf hydrangea; *Polygonatum biflorum*, Solomon's seal; *Polystichum acrostichoides*, Christmas fern; *Viburnum acerifolium*, Mapleleaf viburnum

PLANTS FOR WET HABITATS

These species are for use in and around wet areas such as depressions and swales, wetlands, and stream banks.




Pictured: *Aster novae-angliae*, New England Aster; *Hibiscus moscheutos*, Swamp mallow; *Lobelia cardinalis*, Cardinal Flower; *Monarda media*, Purple Bergamot

Not pictured: *Asclepias incarnata*, Swamp Milkweed; *Cephalanthus occidentalis*, Buttonbush; *Eupatorium purpureum*, Joe-Pye Weed; *Iris versicolor*, Northern Blue Flag; *Lobelia siphilitica*, Great Blue Lobelia; *Vernonia altissima*, Tall ironweed

LARGE SHADE TREES

These tree species are appropriate for use along roadways* and open space trails where shade is desired.




Pictured: **Betula nigra*, River birch; **Liriodendron tulipifera*, Tulip poplar; **Platanus occidentalis*, Sycamore; **Quercus phellos*, Willow oak

Not pictured: *Fagus grandifolia*, American beech; *Ilex opaca*, American holly; *Juniperus virginiana*, Eastern red cedar; *Liquidambar styraciflua*, Sweetgum; *Magnolia grandiflora*, Southern magnolia; *Magnolia virginiana*, Sweet bay magnolia; *Nyssa sylvatica*, Blackgum; *Pinus strobus*, White pine

TREES FOR UNDER UTILITY LINES

These tree species have mature heights less that 30 feet making them appropriate choices for planting under utility lines.




Pictured: *Crataegus viridis,* Winter King hawthorn; *Oxydendrum arboretum,* Sourwood; *Amelanchier arborea,* Serviceberry; *Hamamelis virginiana,* Witchhazel

Not pictured: *Acer buergerianum,* Trident maple; *Asimina triloba,* Pawpaw; *Cercis canadensis,* Eastern redbud; *Cornus florida,* Flowering dogwood; *Cotinus obovatus,* American smoketree; *Halesia carolina,* Carolina silverbell

APPENDIX D // SIDEPATH CHECKLIST

This checklist has been developed by the Knoxville Regional Transportation Planning Organization, based on Chicagoland Bicycle Federation's Tech Sheet.

Its goal is to demonstrate to bikeway planners and designers that no one type of bikeway can meet the needs of every bicyclist. Bicyclists have a wide range of skill levels and needs. When working to develop a safe, cost-effective and convenient bike system, these three principles can help benefit the greatest number of bicyclists:

- Include bicycle and pedestrian facilities in all road projects. Improvements are easier and cheaper when done simultaneously with other changes.
- Target available resources to overcome the most significant barriers for the broadest possible range of bicyclists.
- Maintain as many travel and routing options as possible, allowing people to ride where they feel most comfortable, as long as they follow the rules.

SIDEPATH BASICS

A sidepath is a shared-use facility for bicyclists and pedestrians that runs parallel to a roadway. Many people think that sidepaths are a good idea because they provide separation between bicyclists and motorized traffic. However, studies have shown that bicycling on sidepaths is more dangerous than riding on the roadway. The risk of injuries on sidepaths compared to roadways has been calculated as 40%, 80%, and 260% higher.

The operational problems with this type of facility are noted in the 2012 AASHTO Guide for the Development of Bicycle Facilities.

The AASHTO guide says that shared-use paths operate best when they offer opportunities not provided by the road network and have continuous separation from traffic (i.e., along a river or railroad corridor). The guide lists several operational problems that can occur with paths along roadways, among them:

- At intersections and driveways, motorists entering or crossing the roadway often will not notice bicyclists approaching from their right, as they do not expect wheeled traffic from this direction. Motorists turning from the roadway onto the cross street may likewise fail to notice bicyclists traveling the opposite direction from the norm.
- Bicyclists traveling on sidepaths are apt to cross intersections and driveways at unexpected speeds (i.e., at speeds that are significantly faster than pedestrian speeds). This may increase the likelihood of crashes, especially where sight distance is limited.
- Attempts to require bicyclists to yield or stop at each cross-street or driveway are inappropriate and are typically not effective.
- Where the sidepath ends, bicyclists traveling in the direction opposed to roadway traffic may continue on the wrong side of the roadway. Similarly, bicyclists approaching a path may travel on the wrong side of the roadway to access the path. Wrong-way travel by bicyclists is a common factor in bicycle-automobile crashes.
- Some bicyclists will use the roadway instead of the sidepath because of the operational issues described above. Bicyclists using the roadway may be harassed by motorists who believe bicyclists should use the sidepath. In addition, there are some states that prohibit bicyclists from using the adjacent roadway when a sidepath is present.
- Bicyclists on the sidepath, even those going in the same direction, are not within the normal scanning area of drivers turning right or left from the adjacent roadway into a side road or driveway.

The AASHTO guide recommends that if such a facility is built, there should be wide separation between the roadway and the path to demonstrate to bicyclists and motorists that the path functions as an independent facility.

Note that sidepath facilities should never preclude bicyclist use of the parallel roadway. Experienced bicyclists or bicyclists trying to reach a destination on the opposite side of the roadway will continue to use the roadway, following the rules of the road.

SIDEPATH CHECKLIST

Before proceeding with plans for a sidepath, there is a need to assess whether such a facility is warranted, what other design options are available and which design will best serve the intended users.

To assist with this process, consider the factors presented in this checklist, consult the recommended references and use site-specific engineering judgment to develop a design that works best for bicyclists, pedestrians and motorists.

CHECKLIST FOR SIDEPATH FACILITIES

- Does the combination of roadway traffic volumes, speeds and curb lane widths create poor conditions for bicycling?
- Is it impossible to create wider outside lanes or slow traffic to improve bicycling on the road?
- Are a majority of destinations located on the same side of the roadway as the proposed path?
- Will the path cross few driveways and/or street intersections?
- Is there at least 18 feet of right-of-way width available?
- Can changes be made to signal timing and turning movements to allow bicyclists adequate crossing time across intersections without causing traffic congestion?
- Can the areas around all driveways and intersections be cleared of visual obstructions?
- Can bicyclists safely transition to other bikeways where the sidepath begins and ends?

If you answered NO to two or more of the above questions, it is advisable to reassess the feasibility of constructing a sidepath.

Here's a little more information on each of the items in the checklist above:

1. CAN BICYCLISTS SAFELY USE THE ROADWAY?

Bicyclists are considered vehicles and have the same rights and responsibilities as other drivers. However, a bicyclist's comfort level and perceived safety when using a roadway are influenced by several factors: traffic volumes, traffic speeds, and curb lane width/presence of a shoulder or bike lane.

Neighborhood streets and minor collector roads are usually compatible for bicycling because of low traffic volumes and/or low speeds. Sidepaths are usually not needed along such streets, and investments to improve bicycling would be better used in areas of greater need.

Bicycle Level of Service (LOS) analysis can be done to determine the bicycle LOS on a corridor. If the road scores poorly, then some type of improvement is needed.

2. CAN THE ROADWAY BE IMPROVED?

Explore whether it may be more desirable or cost effective to accommodate bicycles on the roadway with other vehicles than to construct a separate path.

AASHTO has established guidelines for three basic types of on-road improvements:

- Wide outside lane: where the right lane is a minimum of 14 feet wide, excluding curb and gutter
- Bicycle lanes: signed and striped lane for bicycle use, minimum of 4 feet wide, excluding curb and gutter
- Paved shoulders: 4 feet minimum

Modifying roadway cross-sections by shifting lane striping, reconfiguring center turn lanes, moving on-street parking and/or adding extra pavement width can provide space for on-street bicycle accommodations. Lowering speeds through design can also make a roadway more compatible for bicycling.

If on-street accommodations effectively meet bicyclists' needs within the corridor, you may find that a sidepath is not needed.

3. ACCESS TO DESTINATIONS

Bicyclists have both mobility and access needs. When destinations are located on the opposite side of the road from a sidepath, bicyclists must often double back, hop curbs and cross mid-block, or ride in the street against traffic in order to get where they want to go. Such practices should be discouraged because unexpected bicycle movements are major causes of bicycle/motor vehicle crashes.

By comparison, bicyclists riding in the street have the ability to predictably merge lanes and complete turning movements just as other vehicles do. Therefore, planners and engineers need to assess the adjacent land uses to determine whether a sidepath adequately accommodates bicycle access needs.

4. CONFLICTS AT INTERSECTIONS

Studies show that bicyclists who ride on sidewalks or sidepaths incur a greater risk of being involved in a collision with a motor vehicle than those who ride on the roadway. Intersections are especially hazardous for wrong-way riders. (see Figure 1)

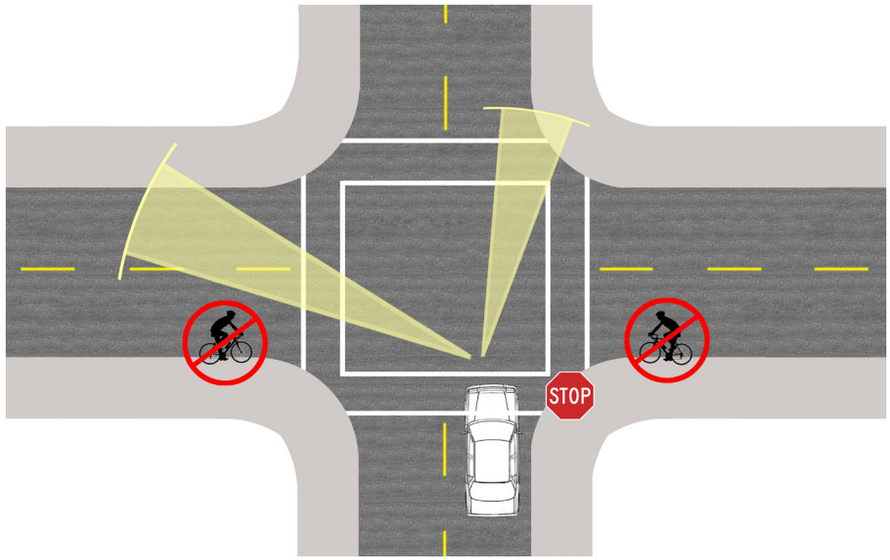


Figure 1: The yellow areas in this illustration show where a driver who's about to make a turn is looking. A bicyclist riding on a sidepath from the left is outside of where the driver is looking and may not be seen. A bicyclist riding from the right (against traffic) is completely unexpected for a motorist. A bicyclist riding on the street with traffic is more easily spotted.

The more often a bike path crosses a driveway or street intersection, the more risk exposures for users of the facility. Commercial strips with multiple driveways and a lot of turn movements are particularly dangerous corridors for sidepaths. Planners must use engineering judgment to determine if a sidepath is feasible based on the number and type of intersections.

SIDEPATH CROSSING RISK

How many points per mile does the proposed path score?

TYPE OF CROSSING	# OF POINTS
RESIDENTIAL DRIVEWAY	1
COMMERCIAL DRIVEWAY	2
MINOR STREET (<1000 ADT)	2
MAJOR STREET (>1000 ADT*)	4

TYPE OF CROSSING	# OF POINTS
LOW RISK: USE SPECIAL CARE	1 – 8 pts
MODERATE RISK: PURSUE ALTERNATIVES	9 – 16 pts
HIGH RISK: NOT RECOMMENDED	> 16 pts

* crossing of a street with >10,000 ADT without a signal automatically moves the proposed path into the high risk category.

The above chart can be used as a guide. In this chart, scoring is based upon a threshold of 12 residential driveways or six minor streets per mile. Beyond this, a cyclist would face more than one driveway every 30 seconds or one street every minute, at which point the safety and utility of the sidepath diminishes dramatically.

5. RIGHT-OF-WAY CONSIDERATIONS

A final physical constraint that may limit the ability to construct a sidepath within a roadway corridor is the amount of space available. According to AASHTO guidelines, a sidepath should be horizontally separated from the roadway to demonstrate to bicyclists and motorists that the path functions as a separate facility. When this is not possible, bikeways located less than 5 feet from the roadway should be protected by a suitable physical barrier of no less than 42 inches high.

To facilitate safe two-way bicycle travel and allow for shared-use with pedestrians and others, paths should be a minimum of 10 feet wide and have an additional 3 feet of clearance to lateral obstructions such as signs, fences, trees, and buildings. This demands a total sidepath right-of-way width of no less than 18 feet.

Full details of bike path design and right-of-way requirements are presented in the AASHTO Guide referenced above.

6. ADEQUATE SIGNAL TIMING

Modifying signal phases may be required to provide safe bicycle access where a path crosses a signalized intersection. Conflicts may be especially prevalent at crossings where the path is controlled by a "walk/don't walk" signal phase with the parallel roadway. The sidepath user may be given a false sense of security by a "walk" signal while turning motorists from the parallel roadway simultaneously have a green light. Right turns on red present another hazard, as do large turning radii that encourage fast turning traffic.

Another important conflict to resolve is created by a left-turning motorist whose attention is focused on gaps in approaching traffic. Upon finding a gap, the motorist often accelerates through the turn and is then faced with an unexpected path crossing.

Design solutions to these problems include use of appropriate warning signs, all red signal phases (a "green" for just the pathway), right-on-red prohibitions, and signal cycles that allow adequate time for bicyclists and pedestrians to cross.

7 . SIGHT TRIANGLES AND CROSSING PLACEMENT

Safety at intersections will be improved if bicyclists are able to see approaching cars, and motorists are able to see bicyclists and pedestrians on the path. This is best accomplished by providing an area free from visual obstructions at each corner of all driveway and street intersections. The minimum size of the sight triangle may be determined by the AASHTO stop control intersection recommendation of 20 feet back from the edge of a travelway. No signs, structures, parked cars or vegetation that blocks views should be permitted in this area. Parallel arterials and rural areas with high travel speeds will require larger sight triangles based upon drivers' stopping distances as per AASHTO guidelines.

More information on intersection design is available in the AASHTO Guide as well as Florida DOT's Trail Intersection Design Handbook.

8. THE END OF THE PATH

How bicyclists enter and the sidepath must be considered. The design of the transition must encourage bicyclists to approach and leave the path traveling on the correct side of the roadway, riding with the traffic flow. Wrong-way bicycle riding is a major cause of bicycle/motor vehicle crashes and should always be discouraged. Safe transitions to another path, an on-road facility or bicycle-compatible street route require appropriate signing, curb cuts and merge areas.

REFERENCES

American Association of State Highway and Transportation Officials

Florida Department of Transportation's Trail Intersection Design Handbook: atfiles.org/files/pdf/trailintersect.pdf

Moritz, William E. 1998. Adult Bicyclists in the United States—Characteristics and Riding Experience. Transportation Research Board. 77th Annual Meeting; Aultman-Hall, Lisa and M. Georgina Kaltenecker. 1998

APPENDIX E // KNOXVILLE REGIONAL TPO GUIDELINES FOR SIGNING & MARKING GREENWAY TRAILS

OVERVIEW

Adequate signing and marking are essential on shared-use paths, especially to alert trail users to potential conflicts and to convey regulatory messages to bicyclists, pedestrian and motorists at roadway intersections.

Both advanced crossing and crossing warning signs are needed on roadways to provide appropriate warning to motorists of the upcoming path intersection. In addition, signage for path users, such as to indicate directions, destinations, distances and names of crossing streets, is helpful for navigating trails. Signs with maps of the entire path route and indicating important destinations should be placed at major trailheads and other key points. The most recent Manual on Uniform Traffic Control Devices (MUTCD) provides minimum traffic control measures that should be applied. Warning signs, directional signs and other devices along the path should also meet the MUTCD guidelines.

Traffic control at path-roadway crossings should be treated so that the intersection looks and functions like a regular road intersection. Path crossings can occur as signalized or unsignalized intersections, depending on the particular attributes of the location. Warrants for signals and beacons are discussed in the MUTCD and could be used as guidance for path crossings as bicycles are considered vehicles. The speed and volume of motor vehicles along the crossing corridor are also an important factor in this analysis.

At unsignalized locations, adequate sight distance should be provided along the roadway approaches to the path and the path approaches to the roadway. In most cases, advanced warning signs should be provided on the road, indicating that a path is crossing the roadway. The path crossing of the street should be marked as a crosswalk since it carries a mix of non-motorized users. Due to the potential conflicts at these junctions, careful design is of paramount importance to the safety of path users and motorists. Each roadway/path intersection is unique and will require sound engineering judgment on the part of the designer as to the appropriate solution. The 2012 AASHTO Guide for the Development of Bicycle Facilities provides examples and guidelines for various intersection treatments.

Refer to MUTCD Figure and Table 9B-1 for size and sign placement recommendations for shared-use paths.

SIGN LOCATION TYPES

The following describes the sign location types and the recommended signage and markings for each.

AT MAJOR TRAILHEADS (THESE ARE GREENWAY ENTRANCES WITH PARKING)

- Big G (Figure 1)
- Entering map (Figure 2)
- Connections map showing how this greenway connects to other greenways, if relevant (Figure 3)
- "No Motor Vehicles" sign (R5-3), if needed
- Courtesy/user behavior sign if desired
- Bollards, if needed (see "Bollards" on Page 5)

ON ROADWAY NEXT TO MAJOR TRAILHEAD PARKING AREA (ORIENTED FOR MOTORISTS)

- Greenway symbol sign—the Big G (Figure 1)
- Greenway identifier (Figure 4)

AT MINOR TRAILHEADS (WALKING AND BICYCLING ACCESS ONLY)

- Big G (Figure 1)
- Greenway identifier (Figure 4)
- Directional/destination signage (Figure 5); if the destination is very close (within ¼ mile), the sign does not need to indicate distance

AT JUNCTIONS WITH OTHER TRAILS OR SPLITS IN THE TRAIL

- Directional/destination signage (Figure 5)); if the destination is very close (within ¼ mile), the sign does not need to indicate distance

AT ROAD CROSSINGS, ON THE GREENWAY

- "No Motor Vehicles" sign (R5-3)
- Yield signs, if sight distance is adequate
- Stop signs, if sight distance is limited

- Directional/destination signage for nearby schools, libraries, shopping malls, bus stops and parks.
- Street name sign for greenway users
- Bollards (see "Bollards" section)

AT ROAD CROSSINGS, ON ROADWAY

- Crossing warning signs W11-15 and W16-7P, with supplemental plaque W16-9P or W16-2aP for advanced warning
- Marked crosswalk
- Stop or yield line pavement marking, set back from crosswalk (see MUTCD for guidance on distance)

DEPENDING ON ROAD TYPE AND LEVEL OF GREENWAY USE:

- Consider raised crosswalk
- Consider center line striping on greenway on intersection approach
- On multi-lane roads, consider median refuge island, signals, beacons and other strategies – refer to the MUTCD.
- On roads with posted speed higher than 40 mph, or roads with 4 or more lanes and ADT over 12,000, a marked crosswalk alone in not sufficient. See MUTCD for additional treatments, or another resource. NCHRP report 562 is a good one.

AT DRIVEWAY CROSSINGS, ESPECIALLY ON GREENWAYS PARALLEL TO ROADWAYS

- At high-volume/commercial driveways, yield signs for greenway traffic, warning sign for driveway traffic (W11-15, W16-7P), and a marked crosswalk.
- For lower-volume driveways, consider signage for greenway users if the driveway is near a curve or is otherwise not obvious, or to warn of a series of driveways.

AT RAILROAD CROSSINGS

- Railroad crossing sign (R15-1) and advance sign (W10-1 for RR crossings ahead, W10-2, W10-3, or W10-4 for RR crossings following a turn)

GREENWAY SIGN EXAMPLES:

Figure 1: Big G sign

Figure 2: Entering map

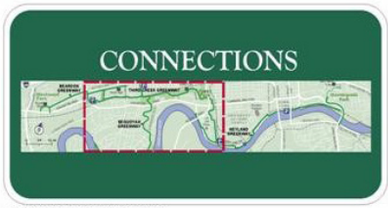


Figure 3: Connections map

Figure 4: Greenway identifier

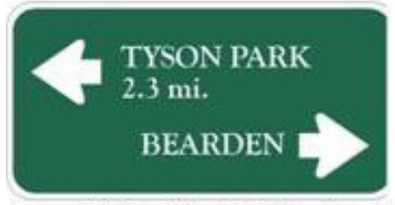


Figure 5: Directional/ destination sign

OTHER SIGNS AND MARKINGS MAY BE USED WHERE NEEDED FOR SPECIFIC SITUATIONS.

Warning users of potential hazards:
"Slippery when wet" (W8-10 and W8-10p)
"Path Narrows" (W5-4a)
"Bump" or "Dip" (W8-1,2)
and others as described in the MUTCD

The R9-6 ("Bicyclists yield to peds") or R9-7 ("Peds keep right, bikes keep left") signs could be used where user conflicts are occurring. Also consider centerline striping in those areas.

If a greenway must be closed for construction, signage should be used to show where the detour is. There should be an advance notice closure sign, a detour sign with an arrow, and a detour map sign.

TERMINI SIGNAGE

Path/greenway termini at roadways should be designed under the assumption that bicyclists and pedestrians may want to exit the greenway to the roadway and access the greenway from the roadway. Each terminus is different and should be analyzed to see what the appropriate treatment is for that intersection. The following are general guidelines to use:

- Analyze how greenways users (bicyclists, pedestrians, skaters) and motorists are behaving at the location. Is there a difference between desired and actual behavior?
- Provide sidewalks along the intersecting road, and design them knowing that some bicyclists will use them.
- Include positive guidance such as signs, pavement markings, and channelization to induce bicyclists to ride on the right side of the road once they have left the greenway.
- Provide educational materials for greenway users (such as courtesy signs listing proper behavior).

BOLLARDS

Where needed, use bollards to keep unauthorized motor vehicles from entering a greenway. But recognize that bollards can be a hazard themselves, especially to bicyclists. In light of that potential hazard, consider these guidelines:

- Use bollards only where there is a demonstrated need: either a history of unauthorized drivers accessing the greenway, or a specific reason to believe that it will occur.
- Maximize the visibility of bollards by locating them properly and using reflective material on and around them.

FIGURE 6: TYPICAL BOLLARD LAYOUT

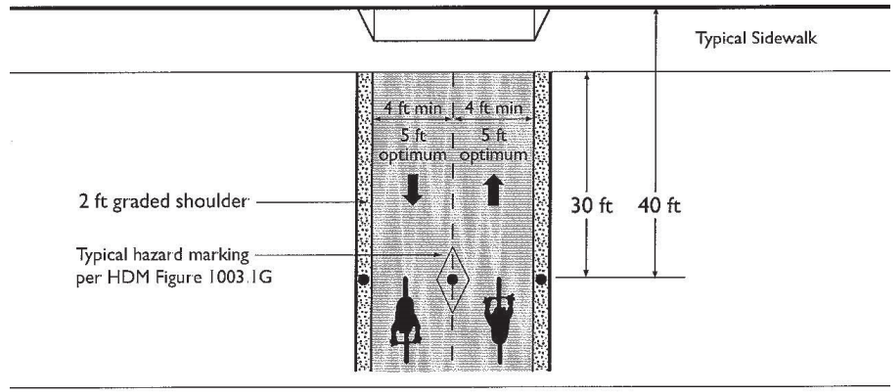


Illustration source: Contra Costa County Trail Design Guidelines

As Figure 6 illustrates, it's best to set bollards back from the trail entrance. This gives bicyclists more time to see the bollard after they enter the trail. Use reflective paint or tape on the bollard itself and in markings around the bollard to make it more visible in low-light conditions.

FIGURE 7: AN ALTERNATIVE TO BOLLARDS

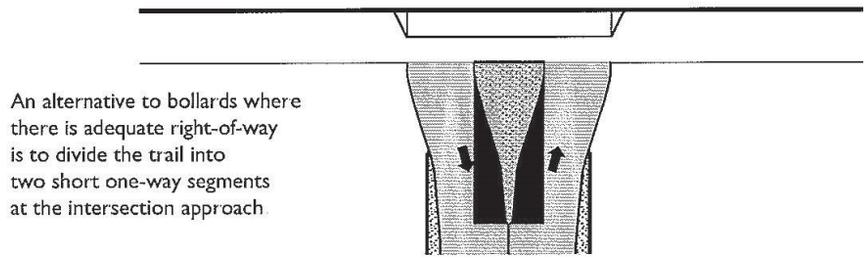


Illustration source: Contra Costa County Trail Design Guidelines

As an alternative to bollards, consider constructing or reconstructing trail entrances so that the path separates into two one-way paths, as in Figure 7. This design will help reduce conflicts between greenway users and keep unauthorized motor vehicles off the path.

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IMAGE CREDITS

Unless otherwise noted, images in this publication are from the collections of the authors, or others listed in the acknowledgments.

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